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Preface (p. 3+6)

Pests and diseases of agricultural plants cause a tremendous harm to agriculture. This harm is especially great during the years of mass spreading of pests and diseases. In Tsarist Russia there were years, when locust destroyed crops of hundred thousands of hectares, when mice used to destroy 50-80 o/o of grain crops in many raion(s) and would damage fruit crops intensively, when the winter worm would destroy crops upon the entire surface of European Russia.

According to the estimation of the entomologist A. G. Lebedev, the yearly sum of agricultural losses of pre-revolutionary Russia amounted to 1.430 millions of gold rubles from harmful insects alone.

During the years of Soviet Power plant protection grew in the USSR conspicuously, and the loss of agricultural crops decreased considerably; but they still continue being quite high, and the struggle for their decrease should be carried out persistently and systematically.

During 1938-1942 the eurygaster caused a tremendous damage to agriculture. It infested several millions of hectares of grain crops.

The cotton losses in 1941 amounted to more than 48 thousands of tons of cotton-raw material in Uzbekistan alone from one disease--vericilliose wilt.

Pests cause great damage in storage economy.

Hence it is quite obvious that in the struggle for the increase of crops of all agricultural crops and the increase in total crops the measures

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in plant protection should be given great attention.

With an early organized, correctly and effectively carried out control of pests and diseases along the entire infested territory the crops not only could be protected against damage, but the nidi of many pests could be destroyed as well.

The task of this guide is to furnish necessary agricultural knowledge to the collective farm instructor and also to the brigade leaders, to assist them in acquiring the methods in controlling pests, to acquaint them with the recipes and applications of the chemical means, rules concerning the usage of poisons, equipment etc.

The guide destined for the reader's attention has been expanded in comparison to previous editions. In this edition are mentioned the following divisions: insecticide plants and their utilization in agricultural pest control, the simplest measures in recognizing chemical substances, pests and diseases of rice, pests and diseases of foddering plants, pests of Kok-sagyz, pests and diseases of oil plants.

These divisions will assist the reader in acquiring many important replies to questions which occur in the practice of plant protection.

Although this guide is destined primarily for the European part of the USSR, but it includes also a series of basic agricultural pests and diseases which are spread in Asiatic part of USSR.

The data included in the guide concerning the productivity of equipment and the expenditure of labor are exemplary and should serve as initial for the achievement of higher norms in the control of pests and diseases.

In controlling agricultural pests and diseases the early and correct carrying out of agrotechnical measures applied for the cultivation of

some plants is most significant; it is especially important in the raion(s) freed from German occupation. During the years of occupation, agriculture in those raion(s) declined. Large fields of land remained unplanted and grew weeds; in those places, where sowing has been done, the agrotechnique was very low since the machine production of the Machine Tractor Stations and of collective farms was destroyed and the simplest agricultural inventory during the years of occupation either became unfit or was destroyed by fascist aggressors.

The decrease of planting fields and sharp decrease of agrotechnical level created favorable conditions for the spreading of pests and diseases and were conducive to the formation of numerous new nidi. In connection with that there is a threat for the agricultural sowing fields which are now restored. This threat could be averted only by carrying out agricultural work and especially by the soil cultivation at a high agrotechnical level, especially by a thorough weed control, and also by means of chemical and other measures of pest destruction.

The measures of high agrotechnique creating the best conditions for the development of plants simultaneously decrease drastically the number of agricultural pests and therefore is recommended as one of their control measures.

In order to avoid repetition, only the most important agrotechnical measures applied against each pest and disease are indicated in this guide. Therefore, when indicating the measures in controlling pests and diseases the agrotechnical and agricultural measures are connected under the term "prophylactic measures".

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In order to find in this guide the necessary informations concerning measures of controlling pests and diseases it is necessary to know upon which plant the said pest or disease has been disclosed; then it is advisable to find in the table of contents the division in which the description of pests and diseases of this plant is given, and to compare carefully the disclosed pest or disease with the description and illustrations included in this division. Pests which damage many plants are described only in connection with that plant for which they are of greatest significance. In those cases when the pest is of secondary importance reference is made to the page where there are more informations concerning it.

Special divisions of the guide are composed and supplemented by the following authors:

Part I has been reprinted from previous editions and partly supplemented by V. S. Chuvakhin.

Part II has been reprinted from previous editions and partly supplemented by B. N. Pastukhov and V. S. Chuvakhin.

Parts III and IV are composed by V. S. Chuvakhin.

Part V has been composed by S. D. Popov and partly supplemented by V. S. Chuvakhin (Tractor pollinator-cultivator OKD and attractant D-2)

Part VI - has been composed: about gophers, mice like rodents, field slugs, locust - by P. V. Zaring; about the rest of grain and legume pests - by B. N. Pastukhov and partly supplemented by V. S. Chuvakhin (wheat nematod, millet moth); "Diseases of grain and legume plants" - by K. S. Mushnikova; "Pests and Diseases of rice" - V. S. Chuvakhin.

Part VII has been reprinted according to previous editions.

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Part VIII has been composed by V. S. Chuvakhin

Parts IX and X are composed by V. S. Chuvakhin - concerning pests and diseases of cotton, pests of kok-sagyz and oil plants; A. M. Nikiforev and B. N. Pastukhov - about the pests of sugar beets, flax and hemp; K. S. Mushnikova - about diseases of flax, sugar beets and oil plants.

In present edition the division of pests of sugar beets has been revised by B. N. Pastukhov, on pests of flax and hemp - by V. S. Chuvakhin.

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Part XIII composed by K. S. Mushnikova.

Part XIV composed by V. S. Chuvakhin.

All remarks concerning this book might be addressed to: Moscow, Orlikov str. 3, Sel'khozgiz, (^{сельхозгиз} 1) Agricultural Publishers, Editor of agricultural literature.

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The fact that plant diseases cause great losses and low crops of cereal, technical plants, fruit, vegetable and food plants is well known. It is sufficient to mention dozens of per cents (and in some cases all 100 o/o) of potato tubers which rot, for instance, as the result of infestation by the fungus Phytophthora infestans. In the past, under the conditions of capitalistic "organization" of production, under the conditions of cruel exploitation of the working class, this fungus caused greatest national disasters. One of such disasters was mentioned by Engels. He speaks of the starvation which occurred in 1847 due to the potato disease in Ireland. As the result of such catastrophe was the death of one million Irishmen and a forced emigration across the Atlantic of two millions who lived on potatoes or almost only on potatoes. ("Dialectics of nature". Moscow, 1933, page 58).

We may also mention the infestation of cereals (wheat, rye, barley and others) by fungi of the genus Fusarium. As the result of the activity of these fungi the crops lost its economic value; in those cases when the population was forced to use such bread for nourishment, severe mass diseases developed. Such a situation occurred also as a result of rye infestation by smut.

Besides the cases, when the harmful activity of agricultural diseases was obvious, a greater number of cases should be taken into consideration, when the disease is very little notice or unnoticed at all by the unskilled observer, nevertheless destroys a great amount of crops.

The socialistic reconstruction of the entire national economy of USSR, the collectivization and the construction of Soviet farms entirely excludes

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at the present time the possibility of repetition of disasters of such character and size to which Engels was referring. Nevertheless, in spite of all our achievements, we are far from that position when it would be possible to say that the socialist agriculture does not have great losses in agriculture. And if the increase of the quantity and the improvement of the quality of crops upon the fields of collective and Soviet farms, in collective and Soviet farms, orchards and gardens, is the central problem of socialist agriculture during the second Five-Year-Plan, then it is quite clear that for the practical solution of such problem, placed before the country by the party and by the government, the study of plant diseases is of primary and often of decisive importance.

Already in previous years, as a result of phytopathological research widely expanded by numerous scientific institutions in various corners of the Soviet Union, the Soviet phytopathologists succeeded in introducing into production a whole series of most important and often entirely new and very effective measures.

I don't consider it as my task to summarize the results of this work, but it is necessary to mention the following facts. In Tsarist Russia the losses from smut alone, according to most modest account, amounted to 10 o/o of the total crops. As the result of utilizing poisoning of seed grains in collective farms, Soviet farms and in individual farms these losses were reduced several times in 1933 in comparison to pre-revolutionary conditions. This progress was achieved in huge collective farms and State farms with the help of new, more effective and cheaper mordants. Of course, even now the losses from smut are quite significant. It is necessary to

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work hard to make these losses entirely unnoticed in our socialistic economy. Nevertheless the given figures indicate undoubted and great success resulting from the great organizational-technical changes in controlling smut.

In the field of protecting potato crops from most dangerous diseases, we may speak now of the most essential results and primarily of the fact that in the very near future the collective and Soviet farms of the raion(s) which are most infested by potato disease, will obtain species immune to this destructive disease, and which at the same time yield high crops, with high contents of starch, with good taste, a good form of the tubers, etc.

From disconnected measures to a system of measures.

We might mention the fact that as the result of a successful collectivization and construction of huge highly mechanized Soviet farms, the initiative of Soviet phytopathologists manifested itself in a series of very successful attempts of shifting from individual and disconnected control measures against diseases to whole, completed systems of measures, both prophylactic and healing-destroying.

No doubt, the future belongs to such a type of work in the field of practical phytopathology.

Nevertheless, it is necessary to note that in this precious work, the Soviet phytopathologists were forced to construct projects of similar systems based upon old data obtained under the conditions of pre-revolutionary farms or even in foreign practice which took place in organizational technical conditions, which differ considerably from the conditions of our collective and Soviet farms.

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Now this gap should be filled in the shortest time.

Basic attention to all species of prophylactics.

The Soviet phytopathology should pay in its system of measures special attention to the division of prophylactic work. It is not necessary to prove that this work provides the most reliable, the most simple and most accessible measures against all, including the most dangerous and the hard eradicated diseases.

For a practical phytopathologist, this signifies that in his further work in constructing and improving complex protective systems, he should pay special attention to the creating of an organic relation with agrotechnique. During crop rotation of cereal, cotton, fruit-vegetable and other collective and Soviet farms concerning problems of pre-sowing preparation of the soil, about timing, depth and ways of ploughing and in a whole series of other problems of agrotechnique, the phytopathological point of view should find a constant and scientifically-founded productively-effective reflection.

During the second Five-Year-Plan, the field of irrigated agriculture in the USSR increased considerably. Phytopathologists should fulfill a series of special research even here, in the new irrigated raion(s), for new plants, so that the irrigated agriculture as a result of corresponding prophylactic measures should yield not only high but immune crops as well, insured against "unexpected" epiphytes.

Other possibilities of prophylactic are closely related to the agrotechnical side of the work of phytopathologists. I have in mind the problems of immunity of agricultural plants to diseases.

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Here it is necessary to distinguish two roads which open to scientific research wide vistas which are of great significance in socialistic agriculture.

The first road, partly assimilated, is the active participation of phytopathologists in the work of creating immune species. Although, as we mentioned already, we are at the present time at the beginning of introducing immune species of potatoes to phytophthora, although there are species of wheat and of oats immune to rust diseases, although vegetable crops has few species with high immunity to various diseases in the field and during the storage of yield, yet it is necessary to mention that the phytopathologists of USSR are in a very insignificant degree drawn to this work. To a greater extent the participation of phytopathologists limits itself to occasional expertisa. At the same time the phytopathologists who utilize the newest methods of physiological, anatomo-morphological and bio-chemical research should become constant participants of systematic work along with selectioners and should assimilate the new species along with the seed growers.

The second course, whose revolutionizing possibilities is hard to evaluate today is - the immunisation of plants. It is entirely outside the sphere of attention of phytopathologists. Until recently many authorities denied even the possibility of immunization and at present time there is no lack in such expressions. Nevertheless, the farther we advance, the less there is decisiveness in such statements because many facts indicate the mistake of such affirmations. It is necessary that the Soviet phytopathology, without any delusion about the absence

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of complications should undertake a further working out of the problems of artificial immunization of plants, starting the work with a critical assimilation of that factual material which has been accumulated at the present time and which does not permit further ignoring of this new and outstanding field of phytopathology. With the necessary attention this field would be able to develop into an independent scientific discipline as it happened with the study of immunity of animals and man.

Until recently all the attention of Soviet phytopathologists was directed to the study of those diseases which caused great damage to various fields of socialistic agriculture. The phytopathologists who worked with these diseases did not pay almost any attention to those diseases of agricultural plants which don't even exist in the USSR. Two principal circumstances escaped the attention of the scientists; first, that these diseases in a series of countries and in individual countries caused great damage to foreign agriculture; second, that the biological peculiarities of the cause of these diseases did not exclude the possibility of their penetrating and spreading within the borders of USSR.

Such severe lessons as the spreading of pseudo-mildew of gooseberry and especially potato canker (In Western Europe) illustrate quite clearly what could happen when there is no sufficient attention to this group of diseases.

Therefore in the future for the development of our work, we should take as the point of departure the following condition: the maximal attention of the Soviet phytopathologists should be concentrated not only upon economically important diseases which exist in USSR, but upon those diseases as well which don't exist at all in the Soviet Union or those which exist

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but which manifest their harm only in a few raion(s) of the Soviet Union. A thorough and wide study of diseases of this second group is the most necessary condition of well-founded and effective application of quarantine measures.

Stepchildren of phytopathology

Among the objects of phytopathological research, as a rule, nonparasitic diseases, bacterioses and virus diseases occupy an insufficient place.

Such a situation should be changed entirely. Nonparasitic diseases should attract the same attention as is given to noninfectious diseases, for instance, the diseases of metabolism. It is necessary to recognize as quite abnormal when the pathological processes, caused by the incorrect regime of mineral food, unpleasant physical influence, etc. are studied only by agrochemists, physiologists, climatologists, etc. The phytopathologist with his specific point of view could and should introduce into his own methods and results of study this important group of diseases. Here we must count the experience of foreign phytopatologists who along with fungi and bacterial diseases dedicate great attention to those plant diseases which are caused by interior and exterior unfavorable conditions (in respect to the plant).

According to the tradition of the mycologists who head the phytopathological work, we devoted until now little attention to that important group of diseases which are caused by micro-organisms and are called bacteriosis. It is possible that our cotton farms, citrus orchards, grain and legume crops and other plants suffered much less from cotton holmoze, from such diseases of citrus as, for instance, "citrus blast"

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and other species of bacterioses, if these diseases would have occupied a corresponding place in scientific research.

A group of virus diseases of occasional character (sometimes subjective) catch our attention only in individual raion(s) of USSR and not because only in these raion(s) these diseases have a serious economic significance. Potatoes, legumes, vegetables, and in recent time also cotton - all these diseases are infested by virus diseases, whose spreading and harm are increasing constantly in a series of cases. A special character of virus diseases, the peculiar ways of their spreading should become the subject of widely organized systematic research. Only in this case could we expect the working out of a series of effective protecting measures against all important manifestations of virus diseases upon important plants.

Chemization and mechanization of controlling plant diseases

Based upon the results of phytopathological research and according to organizational-technical work conditions in collective and Soviet farms, the application of chemical methods of plant protection, in connection with the improvement of corresponding machines and equipment, should be expanded. Until recently the initiative of phytopathologists was insufficient. As the proof of this shortcoming could be considered the fact that, for instance, the most powerful apparatus - the airplane - has a considerably more limited field of application in controlling diseases than it has in controlling pests; the fault lies in the specific peculiarities of the controlled objects. The main idea is that we forgot the special role of the aviomethod in socialistic agriculture, the initiative given to engineers,

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mechanics, pilots and other workers. It is superfluous to mention that the representatives of these qualifications have a harder time in grasping phytopathological problems than the phytopathologists themselves. The phytopathologists should expand in the future a more intensive and initiative work than it has been done before, placing the engineer-constructive thought at the appropriate place.

Improve the organization and the methodology of economical research.

In the practice of phytopathological research for economical reasons, various inspections occupy an important place, and sometimes even consume a great part of strength and means. Nevertheless, this work should be considered insufficient with many items.

The main reason for poor results is the break and dis-harmony in the work itself. Registration, economical systems, quarantine organizations, institutes, Stations for Plant Protection, and finally even separate specialists often work as if in a race, catch separate fragments of problems and thereby constantly leave something unfinished; this has been told by all the personnel which proceeds with the same problem.

Along with the organized confusion there is a great deal to be done for the simplification, increase of accuracy and first of all in the objectivity in the registration methods.

Phytopathology and the biological method for plant protection.

After the Soviet phytopathologists "turned their face to production, they concentrated their scientific research work upon the problems of destroying parasitic fungi and bacteria, causes and agricultural diseases.

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It would be advisable also to take into consideration another side of the work - the possibility of utilizing some fungi as allies in controlling pests and weeds.

More attention to theoretical problems

It is not my task to construct the program of phytopathological work. Not having the possibility of discussing all problems, I consider it necessary to say a few words about the burning question. The workers "feel" that question; they rely on that question and often delay their work on account of that question. Those who work on immunity, or in quarantine institutions, phytopathologists who study the diseases of new plants, professors of universities and of other agricultural schools, and students and finally (and foremost) the mycologists of the Soviet Union - all of them feel it.

What is lacking in the work of phytopathologists? What is necessary to create? A good "flora" of fungi and bacteria; the most needed definitions of fungi are lacking.

The majority of phytopathologists and students do not know the old Russian definitions, and moreover, various foreign "flora"; those which are available are old and do not correspond to the development of Soviet phytopathology, mycology and bacteriology.

This topic should be discussed in more detail in a special article; the concrete most important details and means of solving this problem should be discussed more circumstantially, but even here this burning problem could not be overlooked. This problem could not be solved by one phytopathologist alone, but by organized efforts of a group of them.

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If there will be an organic tie between phytopathological research and production, if there will be an organized and methodically correct collective solution of basic theoretical problems, then we could be confident that in a very short time the Soviet phytopathology will come into existence to replace the present separate, although somehow valuable, phytopathological fragments.

16 July 1951

Pivovarov, V. M.

Methods of control used against the sugar
beet web worm (Loxostege sticticalis L.)
with an estimate of their efficiency.

Zashch. Rast. 1: 103-114. 1935. 421 P492

Transl. 190: Plant Protection

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by R. G. Dembo

The registration of economic effectiveness of measures is the basic organization in controlling agricultural pests. Only with the availability of this registration shall we obtain the possibility of rationally constructing plant protection against pests, directing the losses in such a manner as to obtain the best result from practical measures. In 1933, the year of mass propagation of the Sugar Beet Web Worm, we made an experiment in registering the effectiveness of control measures applied to this pest in productive conditions of the work of MIS (MHC).

The registration has been done upon sugar beets in Semilukskii raion of Voronezh oblast' in the collective farm "Komsomolets."

I. Registration of the effectiveness of chemical control measures.

For the experiment, six fields were put aside: three control fields and three for experiment. The average size of the field in the experiment equals 4 hectares.

The registration method.--Upon experiment fields in 5 places, along the corners and in the center, the amount of caterpillars upon experimental fields of 1/4 of a square m. were counted; thus, the average density upon 1 square m. was obtained. Simultaneously, the percentage of damage of sugar beets leaf surface according to 5-ball system was registered. Thus, were determined the density of caterpillars and the intensity of damage upon all fields before and after spraying. The time of registering and spraying are indicated in table I. The result of the experiment was counted during the harvest by weighing the entire crops.

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Table 1

No. of Fields	When and by Which Compound Sprayed	Time of Registration	Field Sprayed				Field Controlled		
			Number of cat. on 1 sq. m.	% of damaged leaf surface	Yield from 1 h.	No. of cat. on 1 sq. m.	% of damaged leaf surface	Yield from 1 h.	
I	Copper aceto-arsenite	21/VI before spraying	217	0,1	--	160	0,1	--	
		23/VI after 1 spraying	130	5,4	--	260	6,1	--	
		26/VI after 2 sprayings	111	21,2	--	366	19,9	--	
		28/VI after 3 sprayings	79	41	322	304	85,8	142	
II	Arsenic Calcium Oxide	21/VI before spraying	240	0,05	--	155	0,01	--	
		23/VI after 1 spraying	485	11,0	--	395	18,9	--	
		25/VI after 2 sprayings	121	24,3	--	644	34,7	--	
		28/VI after 2 sprayings	100	58,5	299	337	88,6	220	
III	Arsenic Sodium Oxide	21/VI before spraying	111	0,2	--	217	0,01	--	
		23/VI after 1 spraying	55	2,0	--	241	1,5	--	
		23/VI after 2 sprayings	88	8,8	--	1031	30,7	--	
		28/VI after 4 sprayings	84	28,5	383	384	90,1	120	

¹ The spraying upon the III field was done on 23/VI by barium chloride, but unsuccessful on account of the bad weather.

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It is evident from table I that the yield of sugar beets upon the cultivated fields is higher than upon controlled (unsprayed). Thereby, the density of caterpillars, which at the beginning of the spraying were in their second stage, reached at the average 111-240 pieces for 1 square meter. The plants were at this time in the phase of 3-6 pair of leaves.

The general increase of the cost of foddering sugar beets of 2 rubles for 1 centner during the year 1932 is expressed in rubles: upon one field were collected from one hectar 322 centners, counting a yield of controlled, untitled field, we obtain an increase from an hectar 322-142 = 180 centners which, according to the prices of 1932, consists of 350 rubles. Counting the cost of triple spraying of Paris Green [Copper aceto-arsenite] (according to the calculation of MIS OBV 1932) 10 rubles 46 kopak X 3 = 31 r. 38 k., we obtain an economic effect of 1 field cost equals 328r. 62 k.

On the second field from 1 hectar was collected 299 centners at the harvest of controlled, non-sprayed field of 220 centners. Increase of yield 299-220 equals 79 centners or 138 rubles. The cost of work is expressed in the sum of 31 rubl. 32 k. Hence the economic effect from the second field equals 126 rubles. 68 kopek.

On the Third field, the yield of 383 centners during the yield control of 120 c. Increase of 263 c. or 526 rubles. The cost of spraying this field is expressed in the sum of 18 rubles 24 k., and the economic effect equals 507 rubles, 76 kopek.

Taking the average of the three data (on I, II and III fields), we acquire an economic effect for the operative work in the sum of 321 rubles. 02 k. from one hectar of foddering sugar beets.

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II. The effect of agrotechnical measures.

Besides chemical measures of control, of great importance is the agrotechnical method, among which a field of weeds occupies a primary place. The control of weeds is applied not only as a self-aim, but at certain times, it is applied as the method of controlling the sugar beet web worm [Loxostege sticticalis]. Combining these two qualities, the control of weeds in the system of measures against web worm plays a more important role than the chemical measures.

According to our observations in 1932, the spreading of butterflies of the worm on the plantations during laying (and, consequently, infestation) depends upon the availability of weeds of goose-foot and amaranth. Where the field has been weeded out and did not have any weeds, with 100 strokes of the butterfly net, 30 butterflies were caught; nearby, however, on unweeded fields 150-200 pieces were caught. The fields of sugar beets, which perished from web worm, were covered by goose-foot and amaranth; but on fields free from weeds, i.e., at the moment of laying upon weeded fields, there was no laying and such fields almost did not suffer from the web worm.

The time of weeding plays a very important role in controlling the web worm. For the determination of dependency of infestation, we made the following experiment. The sugar beet, evenly overgrown by weeds, was divided into sections which were weeded at various times: 1) before the mass flight, i.e., before the laying; 2) during the mass flight and the mass laying; 3) during the growth of caterpillars and 4) during the second growth of the caterpillars. The obtained data are indicated in table 2.

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Table 2

NoNo Fields	Time of Weeding	Number of Plants		Number of Caterpillars on 1 sq. m.
		Weeds	Sugar Beets	
1	11/VI before mass flight	20	70	10
2	15/VI mass flight	15	70	80
3	17/VI hatching of caterpillars	12	65	92
4	20/VI second stage of caterpillars	10	67	457
5	Not weeded	915	--	915

The best time for weeding out in respect to controlling the web worm could be considered the time before the mass flight of the butterflies. It is also possible to perform the weeding during the mass flight, laying of eggs and the hatching of caterpillars while they are in their first stage (with somewhat worse results), but by no means later. If the density of caterpillars during the weeding at the time of the first stage remained 1,2 pieces, then during the weeding of the second stage, the density upon 1 plant was already 6 pieces. This sugar beet died in spite of spraying after weeding.

The same data were obtained in 1932 and upon the Ramon zonal experimental station (see table 3).

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Table 3

The Influence of Weeds Upon the Infestation
of Sugar Beets by the Web Worm

Place of Registration	Condition of Plantation	Time of Registration	Quantity of Weeds on 1 sq. m.	Quantity of eggs of w.w. on 1 sq. m.	o/o of decrease of inf. eggs of w.w.
Exper. field	Broken, covered with weeds	17/VI	52	72	--
	Broken, and weeded out		0,0	0,0	100
Selection field	Broken and covered with weeds	12/VI	60	417	--
	Broken and weeded out		9	74	83
Agricultural field	Broken, covered with weeds	18/VI	60	316	--
	Broken and weeded out	18/VI	13	82	74
Agricultural field	Unbroken, covered with weeds	18/VI	77	264	--
	"buketirovano"	18/VI	36	160	40

As to the time of the determination of weeding, our data are in harmony with literature indications; but in connection with the time when to start weeding, our data differ from the recommended time of most authors.

Alekseenko (3) recommends: "As soon as the eggs are discovered, it is necessary to cut and to weed out immediately all the weeds from the field and the garden. It is necessary to fulfill that work on time, as

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soon as the laying of eggs came to an end." Koshkin (13) recommends to start the weeding from the moment of mass laying. Zhukovskii (8), Korol'kov (11) "after laying eggs," Arkhangel'skii (4) "at the end of the flight of the butterflies," Pliginskii (17) - "after 3-4 days after the end of flight of the butterflies."

We see that a series of authors recommend to start the weeding for the control of the web worm during various times - from the moment of the discovery of eggs and ending with a very late time - after 3-4 days after the end of the flight (at this time caterpillars already appear). A. Baishchev went even farther, recommending to destroy weeds, as he expressed himself, "in case of mass appearance of the worm," which is evidently not correct.

If we consider the weeding only as a method of controlling the web worm, then the time of its fulfillment becomes very rigid (hard). Svistunov says that an early weeding gives positive results, a very early one and a very late one is harmful." A very late weeding is harmful, because the caterpillars attack the crops and destroy them. A very early one is harmful because before the laying weeds grow which are suited for laying.

It is necessary to take into consideration that from the moment of the appearance of web worm until the laying the flight of the butterflies continues for uncertain time, since in case of the female's sterility, the flight might last a longer time; and, on the contrary, a friendly, short flight of the butterflies usually is a sign which indicates the appearance of caterpillars. Yet there are exceptions to this rule. In 1929 when

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the flight was delayed, the damage was great. Generally speaking, the period of weeding in case of the appearance of fertile butterflies of the web worm is very short. In the year, 1932, this period lasted 6-4 days, counting from the beginning of the flight until the hatching of caterpillars. But if the weeding could be started after the end of the flight or after 3-4 days after its end, as it has been recommended by some scientists, then under such consideration of the problem there would be no possibility of weeding, since at that moment there will be already caterpillars; i. e., the beginning coincides with the end.

Our observations confirm in this case the correctness of the practice of the farm Mainsugar, that the best time for weeding is the time before the flight begins (Bel'skii, 5).

A doubt could emerge that the sugar beet crops or other crops which are free from weeds will be infested directly upon the plants. But our observations and the observations of some other authors - Pliginskii (16), Keppen (10), Pokrovskii (18) indicate the contrary. Esterberg says that "as an exception the butterflies lay eggs upon crops - clover, carrots, sugar beets." Alexandrov (2) gives an example when a somewhat increase of laying was on the sugar beet because during the laying it has been weeded out; but yet the mass laying, according to his opinion, was seen on the weeds; and, therefore, "the weeding of the fields prior to the laying of eggs will be of greatest significance, as a preventive measure."

Carrying out of weeds.--During the weeding the problem of carrying out the weeds is of great significance. Our observations indicated that the gathering and carrying out of weeds with the caterpillars of the first

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stage gives good results; but the carrying out of weeds with caterpillars of the second stage and especially of the third stage and of older stages does not give any results. During the weeding, the caterpillars fall quickly on the ground. The results of registration are given in table 4.

Table 4

Stage of the caterpillars	Density of caterpillars before weeding on 1 sq. m.	Number of caterpillars upon the weeds taken out	o/o of the remaining caterpillars
1	23,9	21,0	0,7
2	28,5	13,8	51,6
3	30,0	0,4	98,7

Thus, according to our data, the carrying out of weeds with caterpillars of the second and the third stage, although useful, is not able to guarantee crops from loss, since the majority of caterpillars remain upon the field. The carrying out of weeds with the caterpillars of first stage under the conditions of 1932 was the main factor in protecting the sugar beet (weeded during the first stage of the caterpillars).

Weeding after the appearance of caterpillars.--As soon as the caterpillars appeared, the interests of pest control and the interests of weed control as far as the sugar beet is concerned are contradicting each other. On one side, the weeding could be dangerous for the beets damaged by the caterpillars of the web worm (with their great amount), on the other side,

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without weeding the sugar beet, is under the danger of death from the effect of weeds. The possibility of a new weeding occurs only after the departure of the caterpillars into the soil. In order to determine the length of the pause in weeding, we are mentioning here the phenological time of the development of the caterpillars of web worm of the first stage in 1932 (Semilukskii raion): 16/VI - when the hatching starts; 18/VI - mass hatching; 19/VI - the appearance of the second stage; 21/VI - the appearance of the third stage; 23/VI - the appearance of the fourth stage; 25/VI - the appearance of the fifth stage; 29-30/VI - caterpillars of fifth stage; 3/VII - the departure of caterpillars into the soil; 4/VII - beginning of cocooning; 6/VII - mass cocooning.

We see that the pause in weeding should occur from 16-18 of June until July 6th, i. e., 18-20 days. I.I. Strel'tsov (22), K. V. Kostrovskii (12) and a series of other authors indicates analogical data concerning the length of the development of the web worm. But if we take into consideration the fact that with the beginning of weeding (i. e., after 18-40 days), this weeding will be finished not in one day, but will be dragged out for a long time, especially if we take into consideration its low productivity, since large weeds grow out, then it will be clear that a considerable part of the sugar beets will stand in weeds longer than one month. The sugar beet which stood in weeds for a long time yields a very low harvest (even after weeding), or dies entirely. Besides, after a prolonged pause, the weeding costs are high - 90 labor days for 1 hectare (since it grows heavily). Under farm conditions in many cases the weeding is not done on account of loss and of uncoming of other important summer work

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(mowing and others). Thus, a considerable part of the beets (if not the entire one) caught by the caterpillars of the web worm and left in the weeds will perish. In the collective farm "Komsomolets" of the Semiluksk raion, as a result of a pause in weeding, 5 hectares of beets were lost.

Thus, a complicated situation arises: both are dangerous, to weed (when the caterpillars appear) and to leave the sugar beets in the weeds. In this problem concerning the loss of sugar beets, there are many serious controversies between the entomologists and agronomists.

I found the solution for this situation. With the appearance of caterpillars even in a threatening amount, the weeding could and should be continued, but it has to be done by rows. The new method of weeding consists of the following: the infested sugar beets by the caterpillar is weeded out only in rows; the width of the weeded stripes should be 15-20 cm. Upon the boundaries (between the rows) the weeds are left unweeded. Thereby, a double purpose is accomplished: 1) the beet plants are freed from weeds, obtain a flow of air and light and grow freely, without being crowded by weeds; 2) the caterpillars remain upon the weeds (which grow on the boundaries) and do not transfer to the beets - thus the beets are protected against the caterpillars.

After cocooning, it is necessary to weed once more, including the boundaries. The experiments gave the following results.

1. Upon the weeds left in the boundaries there were 1.909 caterpillars for 1 sq. m., and upon the beet plants 36 pieces and yet the caterpillars did not transfer to the sugar beet.

2. The percentage of damage of leaf surface upon the field weeded out in rows and left unweeded is almost equal: upon the first there are

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29 o/o, and on the second - 28,5 o/o.

3. The harvest, depending upon the weeding method, varies considerably. This enables the selection of the best method and best time for weeding.

Table 5

The Harvest Depending Upon Time and Method of Weeding.

NoNo of fields	Weeding Method	Time of weeding	Phenology of web worm	Harvest from 1 hectar v. ts.	Cost of crops from 1 h. in rubles
1	Weeding in regular manner	13/VI	Mass flight	144,1	288,20
2	Weeding in "rows"	20/VI	Caterpillars of First and Second stage	170	340
3	Weeding by regular manner	20/VI	Caterpillars of First and Second stage	3	6
4	Weeding after cocooning	--	Caterpillars cocooned	40	80

Thus, the profit of the introduced measure of the weeding by "rows" is expressed in the sum of 250 rubles for hectar or 130 centners. If we take into consideration that the weeding after cocooning does not occur on account of loss, then the sugar beet perishes; the profit of the measure is expressed by the sum of 340 rubles or 170 centners.

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Something similar in the idea, but in a different form, we find with Zverozamb-Zuboskii (9) who furnishes the example, when a "sowing of other plants was recommended between sugar beet rows in order to divert the insects to them." In our conditions this, of course, is inapplicable.

A weeding (in regular fashion) could be combined with spraying; thus, the weeding time could be lengthened also.

It is necessary to underline that the method does not pretend to be the main method in system of measures. It has to be applied, as has been said, during a delayed weeding, i. e., if the caterpillars appeared upon weeded crops of sugar beets in a threatening amount. It is clear that with the early measures against web worm, the application of measures will not be required.

Due to the short weeding (as a control method), there are great difficulties as to labor power; hence - delay in weeding. Therefore, we must devote great attention to the organization of weeding. First of all, it is necessary to determine the alternation in weeding, taking into consideration the threat for various plants from caterpillars of web worm. The practice had shown that the web worm is most dangerous for sugar beets, soy beans, "koriandr" onion, carrots and late sunflower. The weeding of these plants should be given primary attention, as soon as butterflies appear. Such plants as cucumbers, early sunflower, cabbage could be weeded out later. Finally, the plants which are little and rarely damaged, like tomatoes and potatoes, could be weeded last.

Ploughing cocoons.--In controlling the web worm, the ploughing of those places where the caterpillars went into the soil requires attention.

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During ploughing, the cocoons thrown upon the surface will die. The majority of specialists recommend a deep ploughing of the field in early spring or late fall.

In 1932 the ploughing under our conditions could not be applied, since all the caterpillars at the time of departure into the soil were infested by parasites; therefore, we were not able to consider the effectiveness of this measure.

Concerning the problem of the location of cocooning caterpillars, i. e., in the places which are supposed to be ploughed, we find in literature contradictory opinions. Sakharov (20) insists that "the caterpillars of the web worm prefer friable soil for their cocooning." In fall, 1929, and in spring, 1929 (Khmel'nitskii sugar combine and Panin raion respectively), I observed cocooning upon soft soil." Rostovtsev and Pospelov tell us the opposite: "for the cocooning the caterpillars search for soil with hard soil." Alexandrov (2) and Silant'ev (21) express an opinion which is the most correct, that "the cocooning in its main mass occurs in the places of food (sugar beets, transplantation, clover)."

The problem of the places, where the caterpillars hide for winter, is of principal significance because the majority of the caterpillars hide in places of food or mainly upon ploughed fields and on stubble (Dobrovol'skii, 7); the reploughing or harrowing could be coordinated with other farm needs, for instance, ploughing in winter, spring ploughing, etc. Only in such a combination could the reploughing, as a control method, be of some significance.

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The time of sowing.-- There are in literature some indications upon the time of sugar beet sowing as a method for controlling the web worm. But this problem is treated by various authors in a different way. Negrash (15) recommends late sowing, but Bilskii (5), Aleksandrov (1), Bogoiavlenskii (6) and others recommend early sowings. According to our opinion early sowings of sugar beets are more immune against damage by caterpillars since a mass of leaves of the early beets are more than with the later one. Late sowings which do not sprout at the time when web worm's laying of eggs (consideration that the sugar beets is not infested) are of low harvest because of the agrotechnical method.

Mowing of weeds.--In the system of measures in controlling the web worm the cutting of blossoming weeds is given a considerable attention; it (mowing) is prescribed as imperative in controlling web worms.

This measure is given the following basis: it has been fixed that during the flight butterflies accumulate upon blossoming and high weeds for feeding. After the maturing of the eggs, the butterflies fly upon the nearest plants and infest them. Thus, the blossoming and high weeds are sources for infestation.

The foundation of this measure corresponds fully to common sense; the results of the analysis in 1932 forced us to evaluate this measure differently. We took a field with typical weed spots under our inspection. Upon this field we observed a great flight of butterflies and there were dead fields.

The latter had a conformation of the soil with conspicuously expressed straight boundaries. If we compare weed spots with dead fields, it immediately appeared improbable that the cause for sugar beet loss would

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be the influence of weed spots. If they would influence the intensity of infestation by web worm, then there should be a stronger infestation which decreases with the increase of distance, since around those spots were conditions seductive for egg laying. But it became clear that there was no relationship between the distance from the weeds and the infestation degree, i. e.; the role of weed spots as the infestation center was not justified. This led to the idea concerning the expediency and effect of mowing weeds in controlling the web worm and of the necessity of investigating this problem.

First of all, let us consider the fact that there are many places of web worm butterflies accumulation and that they vary.

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Table 6

Quantity of Butterflies Caught by 50 Strokes of the Net in Various Fields

Date	Location	Gen. Amount	Male	Female
13/VI	Field of weeds, shores of the river Veduga..	220	70	30
	On weeds, in bushes, in hollows.....	41	--	--
	On onions.....	121	25	76
	On the crops of sugar beets.....	291	43	57
14/VI	On winter wheat, covered with blossoming weeds.....	187	--	--
	On fields near a park.....	157	--	--
	In a garden protected by a high abrupt slope	Individual flight		
	At the edge of a forest.....	45	--	--
15/VI	On weeds, in fruit conservatory on elevation.....	270	56	44
15/VI	In a garden, protected against wind.....	Noticeable flight		
15/VI	Around the river Veduga on weeds.....	167	--	--
15/VI	The same place, on sugar beets.....	420	--	--
15/VI	The same place, on weeds.....	175	--	--

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The accumulation of butterflies are found not only on weeds, but on plant crops as well, which is impossible to mow so that the butterflies would not accumulate there. Therefore, Puzyrnyi (19) says that a partial destruction of blossoming vegetation could not influence the decrease of butterfly nourishment and, consequently, upon their fertility, since butterflies fed themselves on the blossoms of the linden tree and some foddering grass and other plants.

"The problem of mowing becomes more complicated with the condition that, besides "passive" flights (according to the wind) the butterflies of the web worm - according to Liubomudrov (14) make "active" flights at the distance of 3 km; in search for appropriate laying place, they fly even farther. Therefore, for the full protection against infestation of crops by the eggs of the web worm, it is necessary to destroy blossoming weeds around threatened plants by a radius larger than three km. Taking into consideration many "nidi" and also the fact that "nidi" are not only weeds but crops as well, it is quite improbable, if not even impossible, to create conditions which furnish a guarantee of mowing blossoming weeds.

It has been confirmed by the observations of previous years that the butterflies of the web worm lay their eggs on small weeds which just started to sprout, especially goose-foot, spout, bind weed and others; and on large weeds which are to be mown, the eggs are not laid. Our observations in this problem indicate the following.

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Table 7

Number of Disclosed Eggs and Caterpillars of Web Worm Upon Small and Large Weeds

Date	On Small Weeds (1 and 3 cm. height)			On Larger Weeds			Remarks
	Number of plants on 1 sq. m.	Number of eggs or caterpillars on 1 sq. m.	Average on 1 plant	Number of plants on 1 sq. m.	Number of eggs or cat. for 1 sq. m.	Aver. for 1 plant	
17/VI	700	847	1,2	--	--	--	15/VI start of egg
18/VI	813	896	1,1	Samples not taken			19/VI start of egg hatch.
19/VI	915	915	1,0	93	not disclosed		
21/VI	1189	1250	1,08	95	5	0,05	
23/VI	779	1945	2,5	98	4	0,04	

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It is evident from table 7 what a great difference there is concerning the number of caterpillars upon small and large weeds: upon small there are 1,000 caterpillars or even 2,000 for 1 sq. m. and upon large ones 4-5 pieces.

The observation of Negrash (15) is interesting. He says: "as a rule, the butterflies try to lay their eggs closer to the surface of the soil, and consequently bind weed, sput, "kalachiki," and sprouts of such plants as goose-foot, wormwood were infested by eggs. Bind weed, which twine on cereals, or on other plants, as well as other high plants which do not have root leaves, were almost free from eggs." We see a good example that not only the species of the plant, but its height as well affects the laying of eggs.

In our experiment the field of peas was characteristic where blooming weeds were growing - canonile, hemp nettle, etc. According to literature data, peas are infested first of all. We could insist that peas would be eaten since all the factors were available, which indicated that fact - the flight of the web worm, fecundity of the females, the vicinity of blooming weeds, etc. But yet that assumption was not justified, - peas remained undamaged. Butterflies were searching for small, just sprouting plants; they did not lay eggs upon high plants. Thus the discriminating ability of butterflies has been determined. They search for small weeds which are hard to mow, which, therefore, have to be weeded out. We see that from this point of view the mowing of high blooming weeds in grooves is of no use as a control measure.

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The mowing of large and blooming weeds as a control method did not give any positive results according to our analyses. That does not imply that mowing is entirely unnecessary. According to the requirements of agronomy, we must control weeds. Mowing is one of the measures in controlling weeds. It seems, it is irrelevant by which method we do our mowing - by entomological or agronomical method - but mowing is absolutely essential. It seems the various points of view give only a formal difference, not an essential one. But it is not so. As a matter of fact, the new approach may produce better possibilities for the acceleration in weeding as a control method.

We know already how short is the time of weeding; it is counted in 4-6 days; and therefore the mowing of high and blooming weeds would be done when the weeding is a method of control as it was applied in practice, but at a different time (before or afterwards, this is the problem of agronomy). During those 4-6 days, it is necessary to pay attention mainly at the weeding campaign (period), without weakening the weeding due to mowing. This could be of great benefit, since mowing requires 3-10 o/o of man power at the most responsible moment. These men could be utilized for weeding, which is used as a narrow place in the system of measures against the web worm.

Catching of butterflies.--We give sufficient attention to catching butterflies by drag nets during mass egg laying on crops.

The effect of catching depends upon the width of the grip of the butterflies by drag nets. According to data of Mainsugar, the catching of butterflies with drag nets give positive results, provided they are used

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on a wide belt.

We are giving here some data as a result of catching obtained in collective farms. Two drag nets were applied in our conditions. The width of the grip was 20 m. The catching was done during the mass flight (200-300 pieces during one grip) and mass egg laying. A part of the sugar beet was left as a control. On the same field, approximately 2 ha., the catching was done during two days.

The registration indicated that from 250 plants of the controlled field 107 were infested, and on the tested field out of 250, 104 were infested. The density of infestation in one as in the other case is the same - in average 5 eggs to one plant. During the hatching of caterpillars a difference in the density of infestation on the field, where the catching was done, has not been observed. Thus, the catching of butterflies by drag nets of 20 m. appeared to be ineffective.

C o n c l u s i o n s

1. At the density of 100-200 pieces on 1 sq. m., the caterpillars of second stage, during the plant phase of 3-6 pairs of leaves by spraying with copper aceto-arsenite and with arsenic sodium oxide, the profit amounted to 321 rubles for 1 hectar of sugar beet with the cost of 2 rubles for centner.

2. The freeing of plants from weeds during the flight and egg laying of the web worm is a good measure for protecting crops against infestation, provided they are destroyed by weeding. Weeding, as a control measure, should be accomplished at the beginning of caterpillar hatching.

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3. The weeding of sugar beets with the availability of the second and higher stages with the density at the average of 150 pieces and more for 1 sq. m., during the phase of plant growth of 3-6 pair of leaves, even with the carrying out of weeds does not save sugar beet crops from perishing. In such cases, the weeding could be done only in rows of 15-20 cm. width (on the borders, the weeds are left as attractants for caterpillars). With such a measure of weeding, the sugar beets are freed from the depressing effect of weeds, obtaining a stream of air and light, develops more or less normally. The caterpillars remain on the weeds and do not transfer on the sugar beets. After cocooning, all the weeds are weeded out. The profit from the introduced measure - the weeding in rows, in comparison with beets weeded after cocooning, amounted to 260 rubles or 130 centners per 1 hectare.

4. Taking into consideration the short time for weeding, mainly because of labor shortage, it is necessary to weed sugar beets, soy beans, "koriandr," onion, carrots in the first place, late sunflower; in the second place - on early sunflower, cucumbers, cabbage. On tomatoes and potatoes which are hardly affected, the weeding could be done last.

5. Reploughing as a method of controlling web worm will be of serious significance if it is considered as an obligatory measure (winter ploughing, spring ploughing).

6. Early sowing of sugar beets are more immune to the damage by caterpillars since the mass of leaves with the early sugar beet is larger than with the later sugar beet; therefore, the early sowing of sugar beets could serve as a method with the web worm.

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7. Mowing blooming and high weeds as a control method did not show good results, and therefore this could be considered only as a method of controlling weeds. This enables us to weed, not at the time when weeding is the control method, but to transfer it to a different time (earlier or later). This corrective might give an essential profit, since the mowing at the most responsible moment requires 8-10 o/o of labor which could be utilized during weeding, thus increasing its tempo.

18 June 1951

Methods of control used
against the sugar beet web
worm (Loxostege sticticalis L.)
with an estimate of their efficiency.

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Transl. 191: Plant Protection

A system of control measures against
pests and diseases in the cotton-growing
regions of Central Asia. Zashch. East.
2: 35-44. 1935 421 P942

Translated by R. G. Dembo

From the Editor

Until recently the measures in plant protection were used against individual pests or diseases (for instance smut, corn moth, sugar beet web, worm etc.).

Nevertheless in protecting any plant against damage we deal not with one species, but with a series of species of pests and diseases. In connection with that the working out of complex systems of measures in plant protection is the most important problem. The solution of this problem represents great difficulties.

Separate research carried out without any definite plan hamper the compilation of a complex system of measures. Yet, all these difficulties should not interfere in the working out complex systems of measures. Even the first version, although imperfect, helps in elucidating all gaps and to correctly utilize the achievements already available. Without any critical summary those gaps are difficult to discover.

The article of M. I. Kosobutskii is the first attempt of composing a single system of measures in controlling pests and diseases of cotton.

The editor and the author himself do not consider the published system as perfect. According to the opinion of the editor it has moreover the character of a schedule of measures. No doubt, a series of problems in Kosobutskii system is indicated in general formulations and requires further details and more expanded research. There are few concrete data concerning the rationing of immune forms of cotton, the problems of cotton quarantine are not discussed, the problems of the sowing time the amount

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and the time of watering are not differentiated; there are few concrete data and norms in connection with the depth and the time of ploughing, there are no data on fertilization. No doubt, in the system of measures there should be indicated the problems of location of pests and diseases and an analysis of factors which influence the change in the amount of pests.

All these and a series of other important problems require the experimental solution. In 1935, in particular, the main problem of the cotton section VIZR is the working out of measures for concrete raion(s) along with the division of plant protection of the All-Union Cotton Institute and of Central Asia Station of Plant Protection of the All-Union Institute of Plant Protection.

In publishing the article of M. I. Kosobutskii the editor asks the organizations connected with cotton growing to furnish their ideas and criticism.

The peculiarities in the cycle of development, behavior and the character of damages caused by cotton and alfalfa pests and diseases require that in the struggle for the protection of crops against pests and diseases not only one specific measure in individual case would be applied, but all possible measures would be utilized during the entire year.

This system of measures should include: a) a wide utilization of basic agrotechnical measures for pest and disease control, as: fall and spring ploughing, the cultivation of cotton between rows, the control of weeds on cotton and alfalfa fields, the utilization of crop rotation, the selection of immune species etc.; b) the utilization of the chemical control measure, pollination, spraying, setting poisoned attractants etc. *

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* Of course, the system of measures cannot limit itself only with the group of agrotechnical and chemical methods, and in many cases the physico-mechanical measures, as well as the biological method should be included. Especially, in the system of measures in controlling cotton pests a few mechanical control measures should be included which did not have any significance in some raion(s) until recently (collection of caterpillars of the corn earworm, Chloridea obsoleta, mechanical control measures of locust) and also quarantine.

The editor

Chemical and agrotechnical control measures in controlling pests and diseases should be carried out in such a manner that one measure would supplement the other and that each measure would be applied at definite time when the pests and the diseases are most vulnerable from point of view of effective control.

It is hard to foresee at which time and where the definite pest or disease would appear and therefore it is still harder to give specific scheduled time for various measures. Because of that, the total of chemical and agrotechnical control measures in the yearly system of measures has been divided into four periods more or less differentiated from each other according to the character of work, and namely: spring period (March-May), summer period (June-August), fall period (September-November) and, finally, the winter period (November-February).

Such a grouping of measures according to periods is relative, but this relativity would increase if the measures would have been grouped according to months or to definite timing. It is hard to forecast the time of appearance of pests and diseases for the entire year, and still harder to forecast for various years in various raion(s) of Central Asia.

It is absolutely necessary to accept that individual measures and the entire system will yield the expected effect only when they will be carried out and practiced daily in collective and Soviet farms. It is

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necessary to include in the productive plants of Soviet and collective farms the measures of controlling cotton and alfalfa pests and diseases with such a manner that these measures would be carried out according to a plan.

For the published system of measures in controlling pests, diseases and weeds in cotton raion(s) of Central Asia materials were compiled since the organization of the Central Station of Plant Protection of the Central Asia Scientific Cotton Institute, i.e. since 1929.

Data of separate experiments were united into one system of measures only at the end of 1933 and only as the result of inspection of a preliminary system at large collective farms (Namanganskii kompleks, Turkmenian expedition, Tadzhik expedition, which were organized in 1933 by the Station of Plant Protection of Central Asia Scientific Research Agricultural Institute, the expedition of the All-Union Institute for Plant Protection etc.).*

* For arranging the system of measures in the way as it is published the following materials were used: 1) V. V. Iakhontov according to his work in Sharajudin and at the Station of Plant Protection of the Scientific Research of Agricultural Institute, mainly in the connection of pests with weeds. 2) A. A. Tibilova according to her work in the STAZRA NIKHI (СТАЗРА НИХИ), mainly in the biology of web worm. In this part are also used the materials of IU. A. Piontkovskii and the materials of Namanganskii kompleks, mainly in biocology. 3) P. P. Bogush in his work at Bairam Aliisk of STAZRA NIKHI, mainly concerning "karadrin". 4) L. G. Vitkovskii and M. A. Sosnina, mainly concerning corn earworm in the work at the Soviet farm Vakhsh in Tadzhikistan. 5) M. I. Kosobutskii, in his work in SAIZR and STAZRA NIKHI, mainly concerning the economic significance of pests and diseases and technical and economic effect of the measures. 6) A. V. Vazinger Alektorova, specialists Sizykh and Vitiaeva - preliminary materials concerning the profilactic of watering and agrotechnic in controlling weeds. 7) K. N. Zavodskii and V. V. Iakhontov concerning the measures in controlling phytonomus. 8) P. G. Estifeeva, Serbinov, and Vasil'ev concerning wilt, homooze and adhesive bacteriosis. (Lately it has been determined that the cause for disease is not a bacteria, but an alfalfa bug). 9) The works of S. A. Kharin on alfalfa seed eater and on the introduction into practice of arsenic compounds in controlling mites on weeds. Besides, for the system of measures were used reports of operating organizations and all literary resources on pests, diseases and weeds which exist until now.

The published system of measures could not be considered as something undisputable and unchangeable. According to the change of concrete environment, under the conditions of socialistic reconstruction of agriculture this first system of measure will have to change, supplemented and improved.

1. Spring period (March-May)

1. During the Spring period on cotton raion(s) all basic presowing field cultivation, the replanting of cotton into conservatories, the planting of cotton in the ground (by seeds or by plants from conservatories) are done. During this period the following pests and diseases appear:

- a) the root mite, the field cricket, the seed dividing stage of hommoze and root decay appear in conservatories and damage the young plants; b) upon alfalfa appear the caterpillars of the beetle phytonomus (already in the first days of March) and karadrin caterpillars (at the end of May); c) the web mite and cotton aphids appear and spread widely upon weeds along the boundaries, on slopes and edges of the irrigation ditches, on curbs of fields and roads. On uncultivated spaces the hatching and the development of Marocc grasshopper, "atbasarka", and at the end of May appears also Oasis grasshopper; d) on the cotton itself appears acacia aphid, Plotnikov aphid, the big cotton aphid, seed dividing stage of hommoze; during some summers with a warm spring appears also the web mite.

Here are indicated the basic pests and diseases for the given period, but there is a possibility of the appearance of other pests and diseases.

2. For a correct and early organization of controlling pests and diseases during spring the following work should be carried out on cotton farms; a) inspection and remodeling of sprayers at the beginning of March,

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and also the preparation of poisons and equipment; b) brigadiers of collective and Soviet farms inspect the cotton and alfalfa fields (especially their edges) at least once in five days, they note the field and the pest which appears and organize an early measure which would be indicated for the given pest; c) with the same purpose the brigadiers of collective and Soviet farms inspect (once in six days) the weeds located close to cotton fields and with the availability of grasshoppers and aphids they organize the control of these pests on weeds as it is indicated below; d) along with the inspection of cotton fields the brigadiers of collective and Soviet farms note the degree of weeds on each field in order to compose a plan of hilling which would carry out the hilling on the weeded fields.

3. During the spring ploughing it is necessary to avoid places on which weeds appear rapidly where pests accumulate. On fields covered in previous year by rhizome weeds manual weeding along with ploughing is carried out, and also combing out rhizome by means of harrowing by spring harrows, spring cultivators, grubbing large rhizome by "ketmen". Rhizomes may lie in soil not on the entire field, but by nidi (Curtains), in this case the combing of each curtain is carried out separately in order to avoid the spreading of rhizomes all over the field.

4. Along with ploughing and preparation of the field for sowing the planning of cotton fields is carried out with the aim of eliminating depressions where water accumulates and conditions arise which foster diseases and which also encourage the development of such weeds as *Cyperus*, *Aegonodium podagraria*, "adzhirik" and others.

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5. Immediately after ploughing or simultaneously with it a deep digging of all places covered by weeds (boarders, curbs of cotton fields etc.) and also mowing of weeds by "ketmen" on slopes and edges of irrigation ditches with the aim of decreasing the amount of pests by depriving them the usual nourishment during the critical spring period.

6. During the planting of cotton in conservatories the soil should be taken at the place where there was no hommon previous year. The soil has to be inspected and all the rodent pests (larvae of wire worms, larvae of darkling beetles, cockchafers, caterpillars of winter owl, Agrotis segetum, etc.) are taken out and destroyed. Seeds planted in glasses should be poisoned (see below).

7. In case of the appearance of root mites in conservatories, which is noticeable by drooping and drying plants, or of crickets which is noticeable by gnawed leaflets or by the presence of the cricket itself, the following measures are used: a) in controlling the root mite - an intensified ventilation of the conservatories, b) in controlling the cricket - mill cake mured attractants are thrown in the conservatories.

In planting grafted cotton into soil it is necessary to note the plants diseased by hommoze. If in the glass one plant out of three became infested then this plant has to be taken out from the ground and is destroyed so that the disease would not transfer on the other plants. In case there is hommoze on all plants in the glasses, the glasses should be destroyed. In case the majority of plants is infested then the transplantation should be discussed in each individual case by the agronomist MTS () Machine Tractor Station.

9. The poison of cotton seeds against hemoze before transplanted into the soil. The poisoning is carried out in a concentrated sulphuric acid (125-150 g. acid upon 1 kg bare seeds and 175-200 g. upon 1 kg swollen cotton seeds) or in the solution of formalin (99 litres of water to one litre 40 percent formalin), with the consumption of 17 to 20 litres of solution for 1 centner of seeds, or, finally, by pollinator "AB" (for every kg of seeds 12-15 grams of the compound "AB" is used). In case of seed poisoning in concentrated sulphuric acid the seeds must be carefully washed in running water and should be carefully dried.

10. It is necessary not to plant any other plants (corn, squash) on cotton field in order to avoid the accumulation of pests (mites, "korobochnik", aphids etc.) and their transfer upon cotton.

11. In fertilizing cotton fields it is necessary to exclude from the fertilizers all the waste left from the cleaning of cotton on cotton plants.

12. During the sowing of alfalfa it is desirable that new alfalfa would not be placed directly near the old alfalfa in order to avoid the transfer of phytonomus from the old ploughed alfalfa upon new alfalfa crops.

13. In case of the appearance of caterpillars of winter owl, Agrotis segetum, or of larvae of wire worm and of darkling beetle, it is necessary to place mill cake or green poisoned attractants upon the infested fields from the mowed weeds or alfalfa (the weeds or alfalfa are moistened with 0.1 percent solution of arsenic sodium oxide and is placed in piles between rows upon the infested field). The mill cake attractants are placed under the cotton bushes and are covered by soil.

14. When the cotton starts to sprout it is necessary in the first place to remove the plants which are infested by homose with transparent spots on the seed dividing leaves and to destroy these plants in order to avoid the infestation of the neighboring sound plants.

15. In order to decrease the amount of mites, the delay of the appearance of mites upon cotton and a considerable decrease of the field, it is necessary to start the control of mites on those weeds which surround the field. In the first place it is necessary to pay attention to the weeds under mulberry, weeds, close to "duvala", and weeds on the borders near alfalfa. In this case, carrying out the control on the boundaries, it is advisable to include also the edge of alfalfa in the width of 1-1.5 m.

This control is carried out before the cotton is moved by spraying with sodium arsenate (1-1.5 percent solution) or sodium disulphate (10-15 percent solution) sulphur-oxide emulsions (3-5 percent solution) or, finally, by the waste of petroleum industry "emulsions" (3-3 percent solution) with the consumption of 750-1000 lit pro hectar in all cases.

16. For the control of acacia and squash aphids on cotton the following should be applied: a) spraying by soap-anabazine or soap nicotine solution (4 g soap and 1 g anabazin or nicotine for 1 liter water, with the consumption of 750-1000 liters of solution pro hectar); b) pollination with anabazest or nicodest; for 97-95 kg lime-bloom or wood dust 3 to 5 kg anabazest or nicotine with the consumption of the dusty equipment from 30-40 kg. pro ha. is taken. For the acceleration of aphids for the pollination, wherever it is possible, the application of an airplane is desirable.

Simultaneously the spring inspecting registration of the nidi of the holothurian of grasshopper and of Morocco locust, the composition of the plan of locust control, preparation of fertilizers, the transport of poisons and of equipment to the given places - all this has to be carried out.

17. As soon as the web mite appears on the edges of cotton fields, it is necessary immediately to carry out the edge cultivation including the protected belt in the field, with the width of 3 to 5 m. of boundaries, curbs close to the cotton field etc. In the first place the infested borders of the fields which are close to mulberries, "duvala" and alfalfa should be cultivated.

For this work the following is used, depending on the presence of the pests: a) pollination with Shorsuiskii concentrate of First sort (20 kg. of the concentrate and 10 kg. of wind-blown silt or lime at the beginning of summer and 25 + 15 kg. wind blown silt or lime pro hectar in July and August); b) pollination with ultra sulphur (40 kg. at the beginning of summer and 50 kg. pro hectar in July-August); c) spraying with 4 percent solution of soft soap (750-1000 liter per hectare); d) solution ISO (0.5-0.75 percent according to Box with the consumption of 750-1000 liters per hectare).

In case of further spreading of the web mite into the cotton fields it is necessary to carry out a nest or a full cultivation by the same equipments.

18. Forage alfalfa considerably infested by the larvae of phytonomus should be mown at the very moment when the larvae enter the stage of open life, when they are not locked in buds, but are well noticeable on the alfalfa plants.

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Such a mowing is usually done 8-12 days before the first mowing. The mown alfalfa is harvested immediately and is carried to new places for drying (wide curbs of irrigation ditches, yards of collective farms etc.), and it is desirable to spray the mowed alfalfa with 0.3 percent of solution of arsenic-sodium oxide with the consumption of 750 to 1000 liters solution per hectare the very same day. The purpose of spraying - to kill the larvae of phytonomus which fell during the mowing. With the slight infestation of alfalfa by phytonomus the first mowing is done at the usual time, but for the rest- the same work is carried out, i.e. the mowed alfalfa is carried from the field, but the alfalfa is sprayed by a solution of arsenic sodium oxide.

In case of a serious infestation of alfalfa seeds by phytonomus the latter are volinated with arsenic calcium oxide with the consumption of 10-12 kg. per hectare at the moment when the larvae enter open life.

19. Controlling the Morocco locust Doclostaurus moroccanus, by spraying arsenic calcium oxide (upon uncultivated grounds) with the consumption of 3-4 kg. calcium per hectare or by means of mill cake attractant (in the plant, to avoid burns, only attractants - for 24 kg. mill cake 0.5-0.6 arsenic sodium were used).

The control of Moroccan locust and "atbasarka" should be completed before the appearance of the 4th stage of larvae, since after they get wings the control becomes more complicated.

20. In case of mass appearance of caterpillars of "karadrina" upon alfalfa their control is carried out to prevent the transfer of the caterpillars upon cotton and liquidating the damage of alfalfa by the caterpillars. On forage alfalfa the control is carried out by mill cake

attractant (for 32 kg of mill cake 0.7-0.8 kg. sodium arsenite, and upon seed alfalfa by pollination with arsenic calcium oxide 15-18 kg. per hectar).

21. The control of "atbasarka" in places near cotton, the field cricket on cotton and the oasis cockroach in places covered with weeds and on the cotton by applying mill-cake manure attractants (for every 24 kg. of mixture of mill cake with manure 0.3-0.4 sodium arsenite). In every kg. of mixture there should be 750 g. of mill cake and 250 g. of manure. 15-18 kg. of attractants is spent for one hectar.

22. During the first hilling of cotton along with the hilling the cut weeds in the rows and between the rows are collected immediately by individual portions and are carried away from the cotton fields to prevent the transfer of pests upon the cotton plant.

23. The mowing of weeds along all the irrigation field to prevent the seeding of weeds as well as the liquidation of reserved weed qualities. The mowing has to be carried out before rain along the slopes, curbs, and edges of reservoirs. For drying the mown weeds are carried beyond the cotton fields to prevent the transfer of the pests from them upon the cotton and alfalfa fields.

24. In case of the appearance of the "karadrin" caterpillars, the cultivation of the infested fields is done by pollination with arsenic calcium oxide (young stages) or, if there was no pollination, by throwing attractants (older stages). This chemical control is carried out before weeding, because in case of weeding without preliminary control, the "karadrina" caterpillars transfer to the cotton plant. In the same manner as during the hilling, the pulled weeds are carried out beyond the cotton fields in order to carry out the "karadrina" young caterpillars and eggs

along with the weeds. Besides, on the fields damaged by the "karadrin" caterpillars and extra watering is necessary to promote the growth of the damaged plants.

II. Summer period (June-August)

During this period all between rows cultivations of cotton, watering etc. are carried out on cotton fields. The following pests and diseases could be found upon cotton plants during that period: a) almost before the end of June the mellow and cotton aphid develop and damage cotton, and at the end of the period the fall generation of aphids start to appear; b) at the beginning of May the caterpillars of "karadrin" of the first generation, and at the end of June and the beginning of July appear also the caterpillars of the second generation; c) the caterpillars of corn earworm of the second and third generation start to damage cotton; d) on the fields appear the leaf hoppers and at the end of the period - the stem hoppers; e) the harmful activity of the alfalfa bug starts upon the cotton crops; f) wilt appears on the fields; g) at the beginning of the summer period the oasis cockroach continues to damage cotton; h) the web mite Tetranychus urticae, spreads intensively causing not only edge infestation but nidi and massive infestation as well.

As far as organization is concerned in order to apply the correct system of measures, the collective and Soviet farms are confronted with the following tasks: a) the collective and Soviet farm brigadiers continue their observation of pests and diseases on cotton fields. By means of periodic inspection they register the infestation fields, they organize and carry out those measures which are indicated for that period. The registration of infested and cultivated fields are carried out according

to a special instruction of Registration Division and with the assistance of collective and Soviet brigadiers; b) upon all the cotton fields, covered with the poisoned seeds against homoxe, the technical effect of poisoning is registered; c) in the same manner, with the assistance of collective and Soviet farm brigadiers, is carried out the registration of the technical effect of work against aphids, web mites, "karadrin", "korobochnik" and others; d) according to special instructions of the Registration division with the assistance of collective and Soviet farm brigadiers a special personnel registers the deposit of the holothuria of the Morocco grasshopper, cockroach, "atbasarka" and other locust pests.

From the general system of measures during the summer period the following measures are applied;

1. The cultivation of all fields infested by melon aphids by spraying with soap-anabazin solution or by pollination by "anabadepts" upon line or road dust. These cultivations should be completed at the time when the aphid under the influence of temperature depression or pests and parasites will decrease. During the appearance of summer period of the fall generation the control is carried out on the infested fields by the same ways, by spraying and pollination.

2. The end of the method of mill cake manure attractants against the oasis locust caliptanius italicus?.

3. Control of the "karadrin" caterpillars upon cotton crops; at the beginning of the period the control of the caterpillars of the first generation, and at the end of the period against caterpillars of the second generation. The control is carried out either by pollination of the cotton with arsenic calcium oxide (15-18 kg. pro hectar) or with

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attractant poisoned by mill cake (30-40 kg. per hectare). The pollination is applied against the younger caterpillars and the attractants - against the older ones. Upon the fields infested by "karadrin" before the weeding or before the alternate hilling the same rules are followed as in May, i.e. first of all it is necessary to carry out a chemical control of the "karadrin" caterpillars, otherwise the unpoisoned caterpillars would transfer upon cotton after the weeding.

4. The second and third mowing of weeds on edges, slopes and curbs of reservoirs, along boundaries, curbs of fields and roads in order to prevent the seed producing of weeds and the liquidation of their reserved abilities. The second mowing is done on June 20 - July 10, and the third - July 20 - August 10. The mown weeds are collected and are carried far from the cotton fields in order to avoid the transfer of the pests from the mown weeds upon the cotton.

5. Control of caterpillars of the corn earworm upon cotton crops at the beginning of the period of second generation, at the end of the period with the third generation, by means of pollination with arsenic calcium oxide (18-20 kg. per hectare) or by attractant of dry preparation (10 kg. of small sifted mill cake to 1.5 kg. of arsenic calcium oxide or 1 kg. white powdery arsenic). On one hectare 30-40 kg. attractant is used. Pollination is applied against young caterpillars, and the attractants - against the older ones. In both cases for the acceleration of the work an airplane is advisable.

6. The operating work against the web mite is carried out in the following manner: a) edge work against the web mite are carried out on all those cotton fields, whose edge infestation began in June. During this

edge work: the cultivation of weeds is done simultaneously, first of all on the boundaries which belong to the alfalfa along the fields, and blown weeds (poisons and doses are indicated in the spring period); b) nidi or entire work is carried out on all those fields infested by the web mite where the mite appeared during the spring period, but there was no edge weeding done, or it has been done, but appeared to be unsuccessful. During this work, besides the fields, places are cultivated which are covered with weeds.

For entire cultivation the Shorsuiskii compound first degree is used, if it is available, and ultra sulphur, and also ISO. Upon all maps with massive infestation for the acceleration of work the application of an airplane is advisable; the nidi or mass cultivation of fields against mite with the same compounds of all those fields upon which the edge infestation occurred during the summer period, but there were no edge cultivation, or they were without success. The places of weeds are not cultivated. Cultivation against mites should be completed before September 1. In separate raion(s) and on separate fields depending upon the cotton vegetation the work could be continued until September 10.

7. The additional first and second hillings are carried out and the end of July and August upon fields heavily covered with weeds of root sprouts and rhizomes.

8. Alfalfa heavily covered by root sprouting weeds, intended for ploughing, are ploughed in fall or better in summer, immediately after the third mowing, at the beginning of August with the purpose of drying the weed roots. With the same purpose the fields free from cereals are ploughed in the middle or at the end of July.

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9. During the June, July and August hillings of cotton simultaneously the cut weeds are accumulated and carried out from the cotton field in order to prevent the pests to transfer from the drying weeds upon the cotton.

At the time of the second and third hillings "gumai" forms auxiliary rhines not deeply rooted. With the purpose of decreasing weeds it is advisable to dig out those auxiliary rhizomes, to carry them out from the cotton fields and destroy them.

Besides, on the fields heavily covered with weeds one or two supplementary hillings are done so that by carrying out frequent hillings the covering fields with weeds would decrease.

On seeded alfalfa a periodical mowing of the weeds like "gumai", "kzyl-khiak" and "solodka" is done.

III. The Fall period (September-November)

During this period the ripening and harvest of cotton crops occurs, the fall preparation of fields for the sowing of cotton for the next year etc.

In organizational sense during that period the following work is done: a) registration of the economical effect of poisoning of seeds by sulphuric acid, formaline and by various dry poisons according to the special instruction of the Registration Division, by a special personnel with the assistance of brigades of collective and Soviet farms; b) registration of economical effects of controlling the web mite, cotton aphids, "karadrin", "korochnik" etc. by registering the harvest on weeded and unweeded fields. The registration is carried out at the instructions of the Registration Division by a special personnel with the assistance of

brigadiers of collective and soviet farms; c) the report of every brigadier on the short history of the given fields in respect to the seasonal infestation by pests and diseases, and also by very harmful weeds; d) a fall verifying registration of the deposit of holothuria cockroaches, Morocco grasshopper and other locust. Registration is carried out according to special instruction of Registration Division, special personnel, with the assistance of brigadiers of collective and Soviet farms.

During the fall the following measures are carried out;

1. The cultivation of all fields infested by melon aphids causing the widening of fibers. Control of the fall generation of aphids by the spraying method should be determined before the mass opening of bolls.

During the control from the moment of the boll maturing, when a part of the bolls is already open, only pollination is possible because spraying would spoil the fibers. In case, if the spraying is necessary because another poison is not available, then the same is admissible only after the preliminary collection of all the open bolls.

2. During the first and the following harvest of cotton the raw material (black or yellow skin) is harvested separately and is separately sent to the factory with the inscription "widened". The raw material of the plants infested by hommoze is harvested separately and is sent to the factory with the inscription "infested by hommoze". In cotton factories the infested and widened raw material is preserved and cleaned separately.

3. Immediately after the harvest "guza-pai" is harvested in the following order: a) on fields intensively wilted and hommozed guza-pai is dug out with the rot, and on the other fields a manual or machine harvest is carried out. The weeded guza-pai is taken to the yards of the

collective farms or is haystacked far from the cotton fields. Upon all the infested and weed covered fields fall ploughing is carried out first of all.

4. During the fall ploughing the manual digging out or machine combing of rhizomes is carried out on the fields which are heavily covered by rhizome weeds, then carried out beyond the cotton fields.

5. Simultaneously with the harvest of guza-pai the clearing of leaves under the trees along the reservoirs, the skimming of foliage in piles and burning them in order to eliminate favorable conditions for the wintering of pests like web mites and others.

IV. Winter period (December-February)

During this period the pests and diseases are in a diapause. In mature condition or in the stage of cocoons or larvae the pests are in the soil, covered with ground, in soil fracture, under fallen foliage, in weeds etc. According to these locations the following measures are carried out during the winter period.

1. Clearing the trees from foliage, raking it into piles and burning it in order to destroy the wintering pests.

2. Digging of boundaries, curbs of reservoirs to create conditions unfavorable for the wintering pests.

3. The burning of weeds on curbs of reservoirs to destroy the wintering pests. The burning is carried out only on such reservoirs where there are no trees, otherwise the burning spoils the trees, especially the young ones.

4. The straw and places obtained during the threshing in which the alfalfa seed eater is wintering is given as feeding to livestock until

the end of the winter period. The unnecessary waste, not good for the livestock, is burned in order to eliminate the spreading of the seed eater.

5. During the winter watering of the fields infested by pests, homomys and milt, heavily covered by rhizome, woods must have watering. It is desirable to carry out the irrigation by flooding.

6. The usage as fuel of dzin and other waste obtained on cotton factories in order to destroy the nest available there. The waste not utilized as fuel at the beginning of the spring period (March) is burned to prevent the nests to transfer upon the cotton crops.

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August 17, 1951. No. 192

Translated by R.D.

- p. 1. Soviet Health Care. (Ed.)
- p. 2. Experience in industrial construction at collective farms. Voronezh; building.

August 18, 1951. No. 193

Translated by R.D.

- p. 1. To introduce more rapidly the new irrigation system (Ed.)
Reforestation at Lower Dnepr region. Kiev.
- p. 2. "Viatska-2", new frost-resistant variety of rye, of high yield, produced at Kirov Institute of Agriculture of No.-Eastern USSR under the guidance of well known selector N.V. Rudnitskii. Translated
- p. 3. Among tree shelter belts. Kuibishev obl.

August 19, 1951. No. 194

Nothing of interest.

August 21, 1951. No. 195.

Translated by R.D.

- p. 1. Grandiose construction on the Volga. (decree 8-21-50 to construct Kuibishev Hydro-electric Station on the Volga. (Ed.)
- p. 3. Entrance examination at VUZ are completed.

August, August 22, 1951. No. 196

Translated by R.D.

- p. 1. Cotton harvest begun in Moldavia. Kishinev.

August 23, 1951. No. 197

Translated by R.D.

- p. 1. New method of raising cotton. Tashkent. Translated

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Transl. 192: Plant Protection

On the methods to be applied in record
service. Zashch. Rast. 2:129-133. 1935
421 P942

Translated in full by
R. G. Dembo

The notes of F. L. Kozikov, L. V. Koloukhin and F. S. Pervukhin discuss a most interesting question concerning the methods of work of Registration. Despite the absence of concrete suggestions, the editors publish these notes in order to stimulate an exchange of ideas on this most important problem of plant protection, especially since this fall VIZR (ВНЗР) The All-Union Institute for Plant Protection plans to have a special convention on the problem of the method for Registration.

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Already on the first convention of the workers on pest control, which took place in December 1931, a resolution has been accepted which clearly formulated the responsibilities of the scientific research organizations and of the operating network in connection with the economical significance of pests and the evaluation of the effect of measures in controlling them. By a series of decisions and of conventions of the workers in Plant Protection, it has been determined that the problems of study of losses and effects of the measures should represent one of the basic problems in the work of research organizations. Nevertheless, by reading the latest literature, both the popular and the one which pretends to be scientific in the field of economical significance of pests and diseases, we discover that the figures which are given by the authors in indicating the losses continue to be of the usual standard which sums up to the following index: the decrease of harvest of slightly damaged plants - 5 per cent, for medium damaged - 10-15 per cent, for heavily damaged, not less than 20 per cent, whereby in these standard data with individual authors, an exclusive, conspicuous difference exists which is expressed in

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hundreds of thousands hectares of lost or damaged crops; if these losses are expressed in money - they amount to hundred of millions of rubles. Undoubtedly, this indicates the fact that a majority of authors who did not pursue any circumstantial study in this line indicate figures which are far from reality and which are of subjective and quite orienting nature. At the same time, the amount of operating measures which increases every year should have had more concrete economic bases for the assumption. It would be erroneous to persist that some workers did not make a serious attempt to study the losses from pests and diseases; we have in this direction some results which give us the possibility, especially from the methodical point of view, to approach more closely the study of losses from individual pests and diseases and of the effects of measures. Of great value we may consider during the last two years the works of the coworkers of the economical sector of VIZR - Kosobutskii and others. Being the result of research work acquired as experiments, these data could not be of mass productive character, but represent a value as methodical materials, which is necessary to utilize on the widest scale.

The first source of acquiring the mass materials concerning losses and the effects of measures should be the network of Division of Registration of VIZR (BHZP) All-Union Plant Protection. This was really the main task of the Department of Registration organized by the Division of Pest Control. Unfortunately, this work of the Department of Registration was not developed, expanded nor introduced into a normal channel, as a result of which the systematic accumulation of materials and their work did not progress in comparison with the past. Without being unfounded, let us bring separate excerpts from the opinions of specialists entomolo-

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gists-economists who furnished their report on the work of Division of Registration concerning the losses from certain harmful insects during the pre-revolutionary years and during the period of the first Five-Year-Plan. For instance, Briantsev writes: "The materials during the revolutionary period were not sufficient, especially during the last year of the First Five-Year Plan and the first year of the Second Five-Year Plan, in comparison with the best materials of pre-revolutionary period, but at the same time they are still far from the requirements for an authentic loss registration. The basic elements are the fields infested or damaged by pests, the intensity of their infestation; the data on damage were absent most of the time or were insufficient. Therefore in respect of registering fields and the degree of their infestation, it was necessary to use the methods of extrapolation and interpolation, as to the data on damage it was necessary to give them a provisory significance"... From the opinion of another specialist, we notice that: "The data of the Division of Registration indicate that there is a disproportion of possible losses from individual and group locusts. While usually the losses from the individual and from the group locusts are of the same kind and the losses from group locusts require general attention, the data of the inspection indicate that the possible losses from the Asiatic and Morocco locusts, consisted in 5, 3 o/o in 1932 and in 1933 - 9, 2 o/o. If this is the case, then the centre of attention should be transferred to the individual locusts, although we could dispute it."

In general, all the data on losses of all pests are subjective and do not differ from the data indicated by other authors. Such a condition is not casual. The methodical handbooks which were published by the

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Registration Division even with an ideal application in the work could not furnish more concrete data on the losses caused in our agriculture from pests and diseases.

The content of these handbooks sums up to data of losses, although in some parts they are not void of tendencies in applying the analytical method. The grouping of plants into slightly, medium and heavily damaged, when the difference between the categories is specified from $1/4$ to $1/2$ of the infested or damaged plants could give only the idea of damage, especially since the infestation degree is determined by the eye. Under such conditions the data of the observation points could hardly be utilized as materials for statistical work, and if it is used in our work, then it is not surprising that the obtained results are close to the data on losses acquired by the eye. The handbooks of the Registration Division are insufficient and elementary if we intend to study the losses by an analytical method when the damage is counted as a function from the coefficient of the harm, the intensity of infestation, the number of pests and the duration of their presence upon the plants and when the influence of other factors should be considered, which is as important for the damage as the intensity of infestation.

From all materials offered to the observation points as guidance in loss registration, the best is the instruction written by the specialists G. M. Iaroslavtsev, A. I. Karpova, A. V. Vyrzhikovskaya and P. N. Galakhov for the field entomological observation points of the Registration Division. But it is doubtful whether this instruction is acceptable in the work of the observation points, and especially with the qualitative personnel at the

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present time, when the authors of this instruction write: "It is most difficult to obtain information concerning the influence of damage upon the amount and the quality of the crops. The complexity of the problem of the influence of the damage upon the crops on one hand is explained by the variety of conditions of growth of plants in various raion(s) of the Union in different years, and on the other hand - by the biological peculiarities of the same plants (species, qualities). Only a small part of the pests damages the formed fruits and the seeds when the size and the quality of the crops are in direct relation to the degree of the damage. The majority of pests damage not the productive, but the vegetative organs of the plants, often during the period when the fruits and the seeds were not formed. In such case the plant reacts to the damage while the reaction and the ability of the plant to restore the lost organs depends upon the age of the plant at the moment of damage, conditions of nourishment (soil cultivation, fertilization, heat, moisture, etc.), drought immunity, ripeness of plants, etc."

Of course, it is impossible to argue against such an approach, because only with a profound study of the factors which influence the amount of crops is it possible to speak of the possibility of obtaining if not complete figures, at least quite close to the actual ones. It is only incomprehensible how would the observation points be able to furnish us with those figures without experimental work and without any detailed research of the indicated factors. It is therefore doubtful whether these data will differ from those figures which are obtained by individual persons by the eye, especially since the instruction recommends to use all the cases of slight or heavy damages which could then give the average loss..."

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Without going into the details of individual points of instruction on the loss registration, it is necessary to note that as a whole, it is too huge and complicated: the style is not accessible to the wide masses of the workers in Registration; much of it is the official ideas of the workers of the central office who are very little acquainted with the working conditions of the observation points and still less with the preparation of the majority of workers in case they are required to fulfill this work. According to these ideas the instruction could not be used in practice at the majority of observation points, and therefore is unable to introduce anything new into the solution of the problem. It is necessary to note that the instructions dispatched to the fields suffer from essential shortcomings in their counting of losses of damaged plants. This has to be considered in a special article.

A problem which is also important and essential is the one which considers the effect of measures. Was it solved at the present time? It is possible to say definitely that its solution is not at its best. It is impossible to deny that the Registration Division undertook measures to acquire the necessary data, but the idea of effect in publishing the instructions was of somewhat peculiar character. For instance, the zonal instructions in registering pests and diseases edited by the Registration Division in 1934 suffer of those essential shortcomings that under effect is understood the influence of poisons upon pests and diseases, and it is possible to obtain the data of the effects of the measures according to the amount of change in the plant infestation. No doubt, we could not overlook the fact of the effect, but at the same time it is impossible to overlook other factors related to it.

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It is known that the applied poisons do not remain neutral in relation to the plant, but it produces either a depressing (burns) or stimulating effect, whereby the same poison under different conditions produces a different effect. This situation requires from us to consider the idea "effect" more broadly, on one hand - the decrease of plant damage, on the other hand - the influence of the poison on the condition and the damage of the plant. In reality we observe a loss of 90 per cent and at the first glance the effect is equal to 90 per cent. Along with this there are plant burns up to 60 per cent with the intensity of 15-20 per cent; thus it seems that instead of protecting the plant we oppress it more severely than even the pest itself; hence we don't obtain any increase in crops as a result of the applied measures. The destruction of pests is not sufficient either, because there might occur the death of some percentage of pests, but still the increase of crops might not occur.

More circumstantially is worked out the problem of obtaining some exponents of the effect of the measures under the same instruction of the Division of Registration which we mentioned above, but the latter will not be acceptable neither in registering the damage and the harmfulness nor as the registering the effect of measures for many observation points on account of the fact that the study of economic effect is connected with a deep analysis of other factors requiring the organization of special experimental work.

In order to obtain more concrete data according to the exponents of damage and the effect of measures against basic pests, it seems to us that the essential work system should be constructed in such direction that

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the study of these questions which are insufficiently dwelt upon and which demand more research is essential. From the available network of observation points it is necessary to form 30-40 control points of various directions which should carry out the work of the corresponding experiments.

The number of controlled points is determined by the position that in each basic domain of agriculture (seed, cotton, orchard, sugar beet, etc.) is necessary to form four points in various territorial zone(s), of which two will indicate the loss, and the other two the effect of the measures.

The materials obtained from the given control points are the necessary correctives to the materials obtained in these problems in mass order.

It is necessary to complete the personnel of the control points, especially the supervisory one by highly qualified persons who were occupied in the past with the work in this field. In general, the personnel of the control points could be completed by persons who are graduating from colleges, taking into consideration that many of them are graduates in topics of economical significance of pests and the effects of the measures against them.

For the methodical supervision and a constant control over the work of these control points in the central apparatus of VIZR (BN3P) the All-Union Institute of Plant Protection is necessary to create independent groups to register the damage and the effects based upon existing registration sectors of registration and economics who would perform the theoretical work of the methods along these problems and to give a deep analysis and direction for the entire work of the Registration Division.

These are the present conclusions in the problems of work in registering the losses and the measure effects in controlling agricultural pests and diseases.

16 July 1951

Stepanov, K. M.

Dissemination of infective diseases of plants
by air currents. Zashch. Rast. 2: 83-86. 1935.
421 P942

Transl. 193: Plant Diseases

Translated in full by
R. G. Dembo

(From the work of the Ecological Laboratory SF VIZR)
(cop B W3 P)

In the phenomena of dissemination of diseases, the question of the distance of their motion in the air is of the most theoretical and practical interest.

The understanding of these individual factors of the spreading and of development of diseases, especially their development in locations where the sources of the original infection (for instance, rust) are absent, depends on the solution of this problem. On one hand there prevails an opinion that infectional diseases may spread in the air on very long distances (hundreds of kilometers and more). Often such an opinion is supported by corresponding facts which were determined by numerous analyses of air filled with spores of fungi and by observations of the timing of the appearance of the disease in places remote from the infectional sources. Thus we proved the possibility of the rust infestation which arrives from Manchzhuria into the Amur oblast'. (Shitikova-Rusakova, 1927), in America - its drift from Southern States into Northern States and into Canada. On the other hand, there are data concerning a limited spreading of separate diseases by air streams. According to the data of Jones and Bartholomew (1915), the rust of apple tree, which appeared in a considerable degree in orchards close to weeds of juniper, produced slight infestation in orchards removed from the latter on half a mile or more. Orton and Beattie (1923) describe a case in Columbia where in one place during twenty years neither the

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apple tree near the juniper did suffer from rust, while at the distance of ten miles in that locality rust was violent upon both plants. Butler (1917) in his summary brings a series of historically verified facts of the spreading of such diseases like mildew of grapes, gooseberry and many others and arrives at the conclusion that the wind is not able to spread diseases on long distances.

The indicated facts and many others similar to them do not imply any doubts, but require some clarifications. In reality, the spreading of disease by air is a quite complicated phenomenon, which depends on various moments during which sometimes the diseases are spread at a long distance, in other instances - quite limited distance. Naturally, the question arises - how is this explained, which are the regularities? To determine the latter - signifies the possibility to determine in each separate case the zones of the spreading of diseases, and corresponding deductions derive from them. Although there were attempts made for purely mathematical determination of the spreading boundaries of the infectional origin (Schmidt, 1918), our task is to determine the regularity of spreading infectional particles by the experimental method. The given work was the principal division of special research carried out by the Laboratory of Ecology in 1933-34. As the method of experiments mentioned in this article, we accepted the following: In the open air (the island Elagin and the vicinity of Leningrad) the spores of Tilletia tritici were dispersed clean or in mixture with Bovista plumbea. Before this, glasses were placed on the field of the experiment. The glasses were smeared with

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gelatine-glycerine, in various points, whose coordinates were determined as to the location of the spore dissemination. After a certain time, the glasses were covered by integumentaries, and then the spores were rated. The direction and the speed of the wind, the height from which the spores were dispersed and their amount were determined during the experiment.

As the result of several of such experiments, the following regularity of spore dispersion has been determined. It is expressed by the following equation: $y = c + \frac{a}{sx}$ where y is the distance, sx is the number of spores set on the given field (for instance, upon the integumentary glass), c and a are constants whose significance is determined by the conditions of the experiment (the speed of spore motion their amount, the wind speed, etc.)¹

The character of the dispersion, i. e., the relation of y to x remains unchanged in all cases (excluding those when the dispersion is prevented by barriers - forest, mountains). The practical significance of this equation consists in the fact that according to it, it is possible to determine the zones of spore dispersion in each case for which it is sufficient to evaluate the deposition of spores for one unit of surface in two points differently removed from the source of infection. An example of such zones of dispersion is the scheme presented on drawing 1.

The given equation enables us to determine the zones of the dispersion of diseases, but it is insufficient for the determination of their appearance. It is necessary for this purpose to know some norms of air infestation by spores,² the size of plant surface which is threatened by

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the carrying of infection from afar, the viability of spores, the amount of infection and the conditions of environment (temperature, humidity, etc.). Nevertheless, under corresponding field observations, the determined regularity could be utilized in the work after the availability of additional data for the determination of the mentioned problem. We have in mind the registration of the appearance of spores and the observations of the first manifestation of the disease upon various distances of the source of infection. This could be explained by an example taken from literature (Lambert, 1929).

Spread by the wind from 175 bushes of barberry heavily infested by rust, during 20 hours the following amount of ascidiospores set upon the field of 1 sq. m.: at the distance of 1,8 meters - 1737, and at the distance of 21,6 meters - 11 spores, etc. The observations done after 12 days (when the disease should already manifest itself) indicate that rust spread somewhat farther than 1,5 miles. Hence, we may accept that at the distance of 2 miles (3,3 km.) rust did not appear. According to the equation indicated above, we determine that at the distance of 3,3 km. - the average of 0, 1 ascidiospores settled upon 1 sq. cm. or 1,000 upon 1 sq. m. Therefore, such an overcharge of the air by ascidiospores under the given ecological conditions, did not present any economical danger.

With similar observations under various conditions and in various locations, the "norms" of infestation could be determined. Knowing the latter, it is easy to determine the zones of spreading of various diseases.

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Let us explain it by another example. Let us imagine that as the result of similar field observations, a maximum "norm" for infestation by uredospores of brown rust of wheat has been determined, which under the optimal conditions for the development of the disease does not exceed 1500 spores for 1 sq. mile (or 0,15 for 1 sq. cm.) It is necessary to determine how far could a wheat field infested by brown rust, at the size of 100 h. spread the infection under maximum conditions. We register the settling of the uredospores in two points differently removed from the field along the line of wind, and we determine that under the given infestation degree at the distance of 200 m. at the average 15 spores settle on one sq. cm., and at the distance of 500 m. - 5 spores. How far, under the given conditions, should the settling of the same uredospores occur with 0,15 spores on 1 sq. cm? According to the indicated equation, we determine that this "norm" will be met at the distance of 6 1/2 km. Consequently, at the given moment this field represents a threat for the infection for other crops in a radius up to 6 1/2 km. Further, the amount of spores will increase in connection with the increase of the field infestation, and according to that, under similar conditions, the zones of infectional effect upon that field will also widen. If we determine the dependence between the settling of spores and the degree of field infestation (i.e. the amount of spores on the field) and of meteorological conditions, then such zones could be determined based on those data without any registration of a factual settling of spores.

Many such examples could be indicated. In nature, phenomena are much more complicated, and it is necessary to take various moments into consideration.

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Nevertheless, the very principle of determining the distance of the spreading of the disease remains the same. In order that it could have a more effective significance, it is necessary to develop in the productive environment expanded work on the dispersion of spores and of the distance of spreading of the disease with the registration of the main conditions of the environment. The obtained materials will elucidate the regularity of the dispersion of infectional particles and will give concrete exponents to indicate the boundaries for the spreading of any disease. The important problems in this respect are: "norms" of air infestation by spores, the amount of infection, its consumption in time, the influence of the environment upon the dispersion of infectional origin, etc. Similar work is of considerable practical significance. Its basic purpose is to determine a criterium for a specific evaluation of any source of infection in relation to time and the distance of its harmful influence. This, in turn, produces scientific foundation for a series of measures in controlling plant diseases: the destruction of temporary hosts of rust, the quarantine boundaries, micro-raioning of measures, organization of the sowing field, etc.

Work in this direction is planned for the year 1935 (mainly in relation to rust).

Note 1. The mathematical analysis of our data has been performed by Prof. IU. L. Pomorskii. In using the newest data, this equation was given by Dr. N. A. Naumov in his textbook, "Diseases of Orchard and Garden Plants," Second edition, 1934, page 100. It has been shown in a short report of scientific research work of the All-Union Institute of Plant Protection

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for 1934," page 84 where a misprint occurred: instead of $y = c \frac{a}{sx}$, should

be read $y = c - \frac{a}{sx}$.

Note 2. I. e., the maximal number of spores settled upon one unit of surface during a specific length of time which under the given ecological conditions will not cause the development of the disease in an economically perceptible amount.

Drawing 1. The scheme of dissemination of spores *Tilletia tritici*.

Figures 100, 30, 10, 3 and 1 indicate the average amount of spores settled upon a field of 1 sq. cm. The wind speed during the experiment from 0 to 3 m/c. $2 \cdot 10^9$ spores were disseminated. Scale is 1,6 mm. - 1 m.

16 July 1951

Prokof'ev, A. A.

Additional Factors of Growth and
their role in the life of plants.
Uspekhi sovremennoi biol. 26:943-948;
Nov.-Dec. 1948. 442.8 Er3

Transl. 194: Growth Substances

Translated from the Russian by
S. N. Monson

In the second half of the nineteenth century the dispute between two outstanding scientists, Pasteur and Liebig, attracted a great deal of attention. Both scientists had obtained completely different results in studying the conditions of growth and the enzymatic capacity of yeasts. While Pasteur claimed that a synthetic medium consisting of ammonia salt, yeast ash and sugar was satisfactory for the growth of yeast, Liebig, in repeating Pasteur's experiments invariably obtained negative results. Since the authority of both scientists went unchallenged, the disagreement remained an unsolved scientific riddle for many decades.

Only in 1901, Wildiers succeeded in proving that the addition of insignificant amounts of some organic growth stimulator, named "bios", was essential for the normal growth of yeast, in addition to mineral salts and sugar. The study of "bios," conducted primarily by Kögl and his school (Kögl u. Hasselt, 1936; Kögl u. Tönns, 1936) established that "bios" contains various compounds which stimulate the growth of cells. The group which dissolves in water proved to be the most active part of "bios" and was given the designation "vitamin B."

Elements of bios possessed exceptionally high physiological activity and exerted marked action even in infinitesimal concentrations. Thus, for instance, according to Kögl and Tönns, the component biotin visibly accelerates the development of yeast even in a solution of 1: 40,000,000,000.

Robbins established the activity of similar weak concentrations of thiamin, another part of "bios," upon the growth of isolated roots of

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tomatoes. In the light of these facts the historical dispute between Pasteur and Liebig was solved. According to Wildiers, Pasteur may have introduced into the nutritional synthetic medium a relatively large amount of seed stock which enriched it with elements of "bios." Pasteur consequently observed a normal growth of yeast lacking in Liebig's experiments, who introduced a small amount of yeast cells into the medium. It follows thus that in contrast to many other elements used by organisms for the construction of their bodies, the above substances are required in very limited amounts. They resemble in this respect hormones most of all, of which the most typical representative is, for instance, auxin, the growth hormone.

So long as the participation of these elements in the metabolism of plants possesses a definite characteristic, it is expedient to segregate them into a separate group. The designation, "additional growth factors," given this group appears, however, most inappropriate and unsatisfactory, in our opinion; we shall have occasion to dwell further upon this below. The diversity of additional growth factors, at times specific for a limited group of organisms, equally determines the vast diversity in the metabolism of various representatives of the plant world. We shall restrict our review only to some of them, those most typical and of greatest significance for manifold classes of plants.

GROUP VITAMIN B.

MacCallum and Kennedy named the soluble growth factor Vitamin B. Subsequent studies established that an entire group of elements is covered by this designation. At present 10 substances of diverse chemical composition and physiological activity have been segregated.

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Among these substances those most thoroughly studied are : Vitamin B₁ (thiamin and anervin); Vitamin B₂ (riboflavin); Vitamin B₆ (adermin and pyridoxin); nicotinic acid and its amide.

VITAMIN B₁ (thiamin or anervin). Attempts made to cultivate isolated roots of different plants rapidly led to the conclusion that a medium containing only water, mineral salts and serving as a source of carbon, in the form of glucose or saccharose, is insufficient for root growth. An entirely different result was obtained when autolysis of yeast was added to the above medium. Robbins, (1922), established, for instance, that the introduction into the modified medium of Pfeiffer (containing sugar) of small amounts of yeast-autolysis substances produced definite, positive effects in cultivating cereal root ends under sterile conditions. Later White, (1934), developed the perennial culture of tomato root ends (Lycopersicon esculentum L.) by adding extract of yeast. In his experiments White weekly transplanted newly cut root ends into a fresh medium. The total length of the entire grown root system in a similar culture amounted to tens and hundreds of meters.

In applying a similar method, White (1938) also successfully cultivated roots of many other plants, such as buckwheat, mustard, white clover, petunia, sunflower, etc.

Bonner simultaneously succeeded in establishing the efficacy of the action of yeast extract upon the growth of isolated roots of peas. Thus, at least with regard to some plants, the necessity for stimulating the growth of isolated roots by elements contained in yeast extract was established. Other researchers established the same with respect

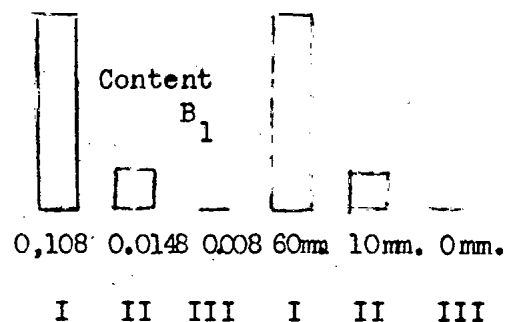


Illustration 1. Corredation (relationship) between content of thiamin and subsequent growth of tips of pea roots in vitro.

I - tips, distant from growing seed; II - corresponds to rootlets that grew in vitro in one week; III - rootlets that grew in vitro in two weeks.

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to lower plants. In this connection the extensive experiments of Schopfer and his assistants who established the outstanding significance possessed by additional growth factors in the life of vegetative organisms with regard to many objects (particularly the fungus Phycomyces) is especially noteworthy. Subsequent study of yeast extract established that the active growth factor resembles in its attributes vitamin B_1 or thiamin. Tests of crystallized thiamin, as an additional growth factor, performed on diverse objects indicated that the latter clearly exerts an exceptional influence upon growth.

On the above diagram (ill. 1), secured from the work of Bonner, (1938), it is evident that the reduction of thiamin content at the tips of pea roots reduces growth. Complete withdrawal of thiamin supply stops all root growth. It follows that the expenditure of thiamin determines the rapid discontinuation of growth of isolated root tips under conditions where thiamin is lacking in the nutritional medium.

A different picture is obtained when yeast extract or pure crystallized thiamin is introduced into the medium. (Table 1)

RAPIDITY OF GROWTH OF CUT ROOTS OF PEAS
(IN MILLIMETERS PER ROOT), BONNER, 1937

Table 1

Experiment	I	II	III	IV	V
Nothing	65	10	0	0	0
0.01 o/o of yeast extract	64	43	45	40	55
0.2 gamma/cm ³ medium B_1	65	72	65	66	65

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According to table I, roots develop identically during the first week, irrespective of the content of thiamin in a medium. But already at the second trial, during the second week, a radical difference is noted between the variants. Roots which do not receive thiamin from the outside grow poorly, rapidly discontinuing all growth (third stage), while roots which are fed with yeast extract or crystallized thiamin grow energetically, with uniform rapidity from stage to stage. Similar results were obtained by Robbins and Bartley (1937) in cultivating tomato roots. The above authors cultivated in successive stages out ends of tomato roots over periods of five months in a medium which contained in addition to essential salts and saccharose, various amounts of thiamin, proving that under these conditions unlimited growth is possible.

Isolated root plants serve only as one of many examples of the significance possessed by thiamin in the life of vegetative cells. Numerous work on the culture of organisms has proved conclusively that thiamin is absolutely indispensable for many fungi, yeasts and bacteria. In his most carefully executed work on Phycomyces blakesleanus, Schopfer (1934) proved that the normal growth and development of fungus occurs only when thiamin is present in the medium. Different combinations of mineral and organic salts, variations in conditions of cultivation, etc., are incapable of ensuring the growth of fungi without thiamin.

Similar results were obtained by Burgeff (1934) with Phycomyces nitens van Tieghem plus and minus; Chaetocladium macrosporum Egff plus, and Parasitella simplex Bainier plus and minus.

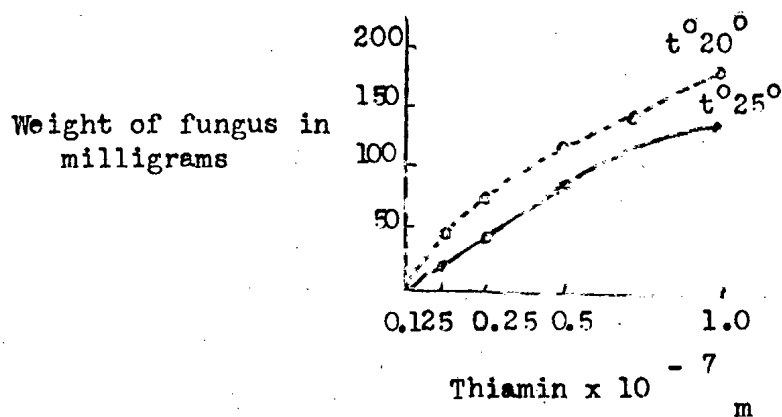


Illustration 2. Growth of Phycomyces in nutritional solutions containing different concentrations of thiamin.

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The dependence prevailing between thiamin content in a medium and the growth of fungus (Phycomyces) is illustrated with sufficient clarity in the curve (ill. 2) secured from the work of Burkholder and McVeigh (1944).

Judging from these curves, the growth of fungi is directly dependent upon the content of thiamin in a medium.

It is necessary to observe, however, that some other fungi, Mucor mucedo M. hiemalis, and M. mucilagineus did not react upon the introduction of thiamin into the medium.

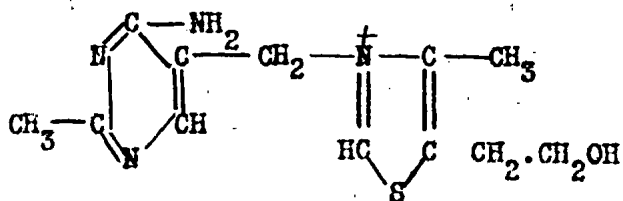
Subsequent work of Soviet and foreign researchers established that various representative plants of the vegetative world react differently upon thiamin. To some the presence of thiamin is an absolute prerequisite, while others are able to dispense with it. (Yerusalimskii and Bulatkin, 1945; Odintsova and Weissel, 1941). The success of the chemical property of thiamin which led to its synthesis permitted to test, along with thiamin, the biological reaction of various derivatives and separate parts of the thiamin molecule. It seemed (as will be shown below) that many organisms do not require an entire molecule of thiamin but only particles of its composite parts.

In order to understand the situation we shall examine the chemical nature of this combination.

The final construction of vitamin B_1 was established by the end of 1936, following which its synthesis was performed by different methods. According to the formula proposed by Williams, thiamin represents a combination of pyrimidine and thiazole nuclei connected by a methylene bridge.

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Pyrimidine Nucleus

Thiazole Nucleus

Tests of various groups of thiamin molecule established the following to be active: In the pyrimidine nucleus the group NH_2 and in the thiazole nucleus the oxyethyl group $\text{CH}_2\text{CH}_2\text{OH}$ and CH . The blocking of the above groups inactivates thiamin as a growth factor either entirely or reduces its activity radically.

The acquisition of chemically pure thiamin was followed by numerous experiments directed towards determining the influence of thiamin upon the growth reaction of various classes of plants. The amount of scientific papers dealing with the need of thiamin by bacteria, fungi yeasts, individual organs, and entire groups of superior plants is at present numbered in the hundreds.

These studies, which cannot be enumerated here, established the different reaction to thiamin on the part of various vegetative organisms. It was disclosed that an entire group of plants, while existing under usual, normal conditions does not react to the external introduction of thiamin. Since the presence of thiamin in these plants was, however, established, the conclusion could be reached that similar organisms are capable of synthesizing thiamin from their usual sources, carbon, nitrogen and ash. Contrary to these autotrophic plants, there are some altogether incapable of synthesizing thiamin. The existence of these

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organisms is possible only if thiamin is present in the nutritional substrata. Apart from these extreme groups, there are also organisms which accomplish synthesis of thiamin from its components pyrimidine and thiazole. Some of them are capable of only uniting thiamin and thiazole into the thiamin molecule; others possess the capacity of synthesizing... one of the components and require for additional "feeding" only the remaining lacking part of the molecule.

Thus, it is possible to arrange for a certain classification of vegetative organisms, by using as a basis the capacity of plants to synthesize thiamin. (table 2).

Table 2

CAPACITY OF VARIOUS GROUPS OF PLANTS TO SYNTHESIZE THIAMIN

Group	Normal development in medium containing:	Some Representatives
I	--	Green, photo-synthesizing plants; some moldy fungi (<u>Aspergillus niger</u> ; <u>A. flavus</u> ; <u>A. orizae</u> , <u>Penicillium Ad</u> , etc.)
II	thiazole	Isolated tomato roots; some fungi (<u>Phycomyces ramannianus</u> , <u>Mucor ramannianus</u>)
III	pyrimidine	Many fungi, parasites and saprophytes (<u>Phytophthora fagopiri</u> , <u>Pithium Butleri</u> , <u>Sclerotium delphini</u> , <u>S. Rolfsii</u>) acetone-ethylic bacteria
IV	thiazole and pyrimidine	Isolated pea roots; some fungi (<u>Phycomyces Blakesleanus</u> , <u>P. hitens</u> ;) yeasts (<u>Torula Laurentii</u> , <u>T. fermentati</u>); bacteria (<u>Staphylococcus aureus</u>).
V	thiamin	Some fungi and parasites (<u>Phytophthora cinna momi</u> , <u>P. capsici</u>).

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As shown in table 2, the entire group of green, photo-synthesizing plants, as well as some moldy fungi do not require normally a supply of thiamin.*

Representatives of group II are capable of synthesizing pirimidine and require therefore only the addition of thiazole, building thiamin up themselves; various fungi belong to this group.

Group III includes organisms which synthesize thiazole and therefore require pyrimidine in order to produce thiamin. Many fungi, parasites and saprophytes, acetone-ethylic bacteria belong into this group.

Representatives of group IV have very limited synthesizing capacity. They are capable of producing for the thiamin molecule only a combination of two complete nucleii, pyrimidine and thiazole.

This type has its representatives in all classes of plants, beginning with superior plants (roots of peas) down to the lower (fungi, yeasts and bacteria).

Plants of group V require for their normal growth prepared thiamin molecule which may not be replaced by any combination of components, pyrimidien and thiazole. Several parasites (Phytophthora cinnamomi, P. capsici), that are supplied by thiamin synthesized by the host-plant belong to this group.

The measure in which components of thiamin may substitute for thiamin is demonstrated in the example of cultivated, isolated pea roots.

* According to Maevskii (1937), microbes that produce abundant growth on ordinary media possess a high capacity for synthesizing substances of the Vitamin B group.

(Table 3).

Table 3

ACCORDING TO BUNKER, 1938

Growth Factor	Additional growth in mm in one week			
	above the control molar concentrations			
	10-5	10-7	10-9	10-11
Thiamin.....	40	40	34	10
Pyrimidine plus thiazole.....	40	43	36	14
Pyrimidine alone.....	0	0	0	0
Thiazole alone.....	0	0	0	0

As seen in table 3, the addition of thiamin or ad mixture of corresponding amounts of pyrimidine and thiazole produces a similar effect. Separately, thiamin and thiazole do not influence growth at all. Table 2 shows that closely related organisms differ occasionally in their reaction to thiamin and its components. To illustrate this statement further, we shall refer to data on yeasts of the genus Torula, obtained by Robbins, 1938, and Odintsova, 1940, (Table 4).

Table 4
NEED OF THIAMINE AND ITS COMPONENTS BY VARIOUS SPECIES OF TORULA

SPECIES	POSITIVE REACTION TO ADDITION IN MEDIUM
<u>Toruly kefir</u>	Thiamin
" <u>cremoris</u>	
" <u>laurentii</u>	Pyrimidine plus + Thiazole
" <u>fermentati</u>	
" <u>rosea</u>	Pyrimidine
" <u>sanguinea</u>	
" <u>latvica</u>	

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An analogous picture was observed by Schopfer and Blumer (1938) in their studies of different species of the genus Ustilago. Among 10 studied species 7 developed normally without thiamin; 1 was weakly stimulated by thiamin; 1 was satisfied with a mixture of pyrimidine and thiazole, and finally, the species U. scabiosa depends for its development exclusively upon thiamin and does not grow on a mixture of the latter's components.

Table 4 shows that within the limits of one genus it is possible to find representatives of almost all groups.

An uneven reaction to thiamin on the part of isolated tomato roots or peas takes place frequently within the limits of different races of one species.

As noted above, some plants do not react upon the addition of thiamin to the medium. Is it, however, possible to draw the conclusion therefrom that the given organisms, specifically plants containing chlorophyll, are able to get along without thiamin?

Many studies convincingly established that all green plants contain in their tissues perceptible amounts of thiamin. Thus, Schopfer (1936), for instance, in analyzing the leaves of 134 species of plants found that all provided for the development of the fungi Phycometes, i. e., contained thiamin. In his summary Bukin, (1940), cites data concerning the content of thiamin in different plants, the presence of the latter being apparent not only in organs filled with chlorophyll, but also in roots, fruits, seeds, etc. An analysis of the body of low

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vegetative organisms which develop beautifully in synthetic mediums that lack thiamin indicates that in this case the plant tissues contain thiamin. Schopfer and Jung in adding to the medium extracts from various species of moldy fungi (genus Aspergillus) established that the mycelium of all tested species contains an adequate amount of thiamin to ensure the normal growth of the fungus Phycomyces. Thus, there is every opportunity to believe that thiamin plays a substantial role in the metabolism of any vegetative organism.

ROLE OF THIAMIN IN METABOLISM. The exceptional significance of thiamin for the life of animal organisms produced numerous studies devoted to the determination of the mechanism of its action. Here one should first of all note the work of Lohmann and Schuster, 1937; Stern and Hofer, 1937; Tauber, 1937 and 1938, who proved the prosthetic group of the enzyme of carboxylase; i. e., cocarboxylase is a pyro-phosphoric ether of thiamin. According to Engelhardt and Wenkster, 1943, thiamin in the living cell consists "either in its initial, non-phosphorylated form or in phosphorylated form as the part of the enzyme proteid (in yeasts in carboxylase, in animal cells in pyruvo-dehydrase.)" In the latter case, i. e., as a prosthetic group, thiamin participates in the oxidization of pyro-racemic acid. So long as the significance of pyro-racemic acid and its transformations in carbohydrate metabolism is known, it is possible to assert that one of the functions of thiamin is in its capacity to participate in carbohydrate metabolism. Subsequent work in the field of animal bio-chemistry, however, showed that the role of thiamin in the metabolism of cells is considerably wider and touches upon

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fat and protein metabolism, in addition to carbohydrates. The work of Kritzman (1940, 1943) showed that thiamin "enters into the composition of different enzyme systems which are responsible for the various transformations of alpha-keto-acids." The experimental data of Kritzman and others indicates that during B₁ avitaminose there is a slowing down of those transformations of amino acids which are connected with keto acids (regenerative aminization and trans-aminization).

Thus, the lack of thiamin leads to the disruption of decarboxylation and oxidation, as well as of reactions of condensation of alpha-keto-acids, which have a "determining influence upon the use of keto-acids in the synthetic phases of carbohydrate, fat and protein metabolism" (Kritzman, 1943).

The above explains why the lack of thiamin in rations of animals causes so many different ill effects. Evidently this equally applies to plants. A good argument in support of the latter is the absence of growth of many vegetative organisms in mediums lacking thiamin. A series of papers written by Soviet microbiologists (Odintsova, 1940, 1941, 1941a; Meisel, Trofimova and Lisovskaia, 1945; Meisel 1940, 1941) showed that the introduction of thiamin into a medium not only encourages the tempo of growth but reflects equally upon the morphology and physiology of the vegetative cell. Thus, for instance, cells of the yeast-like fungus Endomyces magnusii are enlarged under the influence of thiamin, the expansion in size extending also upon the nuclear apparatus of cells. Simultaneously an accelerated deposition of glycogen is observed, similar to the accumulation of glycogen by animal tissue which received thiamin

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and glucose. The writers observe at the same time the accelerated enzymatic capacity of fungi under the influence of thiamin. This served as the basis for the supposition that thiamin should be viewed as one of the primary factors which determine the enzymatic function of the cell which develop in the process of adjustment to anaerobic conditions of existence. (Odintsova, 1941).

Proceeding from the importance of thiamin in plant metabolism, attempts were made for additional feedings with solutions of thiamin of photo-synthetic plants, cultivated in sandy or soil cultures. However, except for the experiments of the Bonners, Bonner D. and Bonner J. (1940); Bonner J. and Green, (1938) with mustard and cosmos which gave positive results, the remaining studies (Minnum 1941a, b; Swarz, 1941; Hamner, 1940; Templeman and Pollard, 1941) did not disclose any effective action of thiamin upon the growth, general habitus and yield of plants. The analogy with the growth of the fungus Phycomyces was complete; supplied by thiamin, through introduction into its medium, there was no further reaction to increases in thiamin content. This leads to the conclusion that a normally photo-synthesizing plant is capable of supplying itself with the necessary amount of thiamin. Organs lacking chlorophyll react altogether differently. As shown above, isolated roots are unable to grow in a medium lacking thiamin. A similar need is felt by entire plants placed in the dark. In this case all material data adequately testifies to the fact that the absence of an external supply of thiamin leads to the rapid exhaustion of its stores in the organism and results in discontinuance of growth and death. The degree in which expenditure of thiamin takes place in this

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connection is shown in the work of Ovcharov of the Institute of Plant Physiology of the Academy of Science, who studied the change in the quantity of thiamin in connection with seed germination. (Table 5)

Table 5

VARIATION IN AMOUNT OF THIAMIN DURING SEED GERMINATION OF WHEAT (1945)

Duration of germination in days	Amounts of thiamin in gamma	
	Per gram of dry matter	Per 100 plants
0	6.95	15.40
2	4.38	10.50
5	3.32	6.66
8	3.12	6.07

Table 5 proves that during seed germination of wheat there is rapid expenditure of thiamin. One may suppose in this connection that the additional feeding of superior plants with thiamin, while it may produce positive effects, may take place just in the phase of hetero-trophic feeding, i. e., feeding at the expense of the supply of seed or organ. This consideration may be accepted as a basis for different methods of seed "hormonization" (Tovarnitskii, 1937; Tovarnitskii and Rivkind, 1937).

The degree in which treatment of seed by thiamin may reflect upon the growth and development of plants is shown by studies made by Ovcharova, 1946. This writer treated wheat seeds before planting with a solution of thiamin and yeast extract and obtained a more rapid growth of treated plants as compared to the control. In the final summary

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"vitaminization" reflected upon the increase of yield of the entire mass, as well as the yield of seeds; in addition, one may point out that treated plants produced larger seeds. (Table 6)

Table 6

INFLUENCE OF TREATMENT OF SEEDS BY THIAMIN AND
YEAST EXTRACT UPON THE YIELD OF WHEAT (1946)

VARIANT	Above ground mass (bulk)		Weight of 200 seeds	
	g	o/o in relation to control	g	o/o in relation to control
Control (Water)...	18.8	100	4.6	100
Thiamin.....	26.9	143	5.8	126
Yeast extract.....	25.3	136	5.5	119

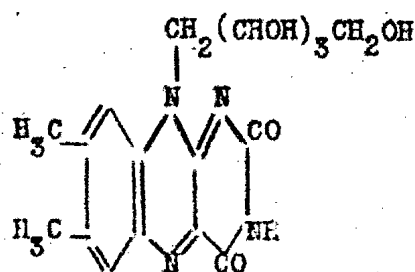
To quote another example, one may refer to the experiments of Went, Bonner and Warner, 1938, who showed that peduncles treated with thiamin, when exposed for some time to the effects of indole-acetic acid developed a much more vigorous root system than peduncles (stalks) treated only with hetero-auxin.

The study of the connection between the mineral feeding of plants and the synthesis of thiamin in them points to the close connection between these processes. Data accumulated at present testifies to the fact that an increase in potassium, nitrogen and phosphorus feeding of superior plants stimulates the synthesis of thiamin, which in turn does not fail to react favorably upon the tempo of growth and yields. As to the significance of thiamin for crops of lower organisms, it is indispensable for the majority of these.

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VITAMIN B₂ (Riboflavin). Among other substances of the group Vitamin B, B₂ occupies a special place. Despite its relatively complicated composition, its molecular structure was established precisely. As determined primarily by the work of Kuhn et al., the nucleus isooalloxazin is at the basis of the Vitamin B₂ structure, combined with a carbohydrate derivative of ribose. This led to the naming of Vitamin B₂ "riboflavin," a term now commonly accepted.



Riboflavin

Obtaining flavins from different vegetative products indicates that they are widely spread in vegetative organisms. It is true that the majority of plants contains a relatively small amount of riboflavin and Kuhn, for instance, was compelled to process three tons of lemons in order to obtain 0.6 g. of the substance. The peculiar characteristic of riboflavin consists not in the extremely small content of this particular class of compounds, but to the contrast with other substances of group B₁ and specifically thiamin; the characteristics of B₂-avitaminose were not observed among larger groups of animals and plants.

At present the curtailment of growth among rodents is not disputed whenever riboflavin is lacking. Numerous attempts to influence the growth of various plants by riboflavin indicate that in the majority of cases

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the latter do not react upon an additional feeding of vitamin B₂. Thus, Burckholder et al., for instance, note that none of the 110 species and "races" of yeasts studied by them required the addition of riboflavin. Similar results were obtained by Rogosa (1943), who also experimented with various yeasts and by O'Kane (1941), who studied Staphylococcus aureus.^{*} Bonner and Deverian (1939), in cultivating isolated roots of peas in media containing riboflavin, did not discover any visible effect from the introduction of the latter. Evidently, only bacteria of lactic-acid fermentation and some pathogenic microbes (species of Streptococcus) among the number of studied organisms require riboflavin for their normal development.

With regard to green plants, additional feeding with riboflavin does not produce any apparent effect.

The studies of Warburg, Christian, Teorell, Haas, et al., indicate that riboflavin represents a component of certain respiratory enzymes, forming their prosthetic group. "Enzymes of this type act the role of hydrogen-transporters in different oxidative-metabolic processes of the living cell as a result of the oxi-reduction in the alloxazin cycle." (Kuzin, 1946).

Thus, there is no doubt concerning the importance of riboflavin for the metabolism of vegetative organisms. The limited response of the predominant majority of plants to riboflavin may be explained by the fact

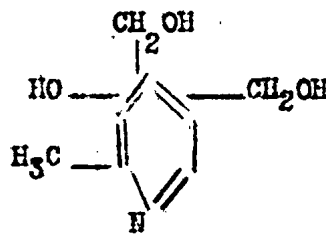
^{*}According to Yerusalimskii and Neronova (1946) acetone-ethylic bacteria do not react to the addition of riboflavin to the medium.

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that its synthesis is easily accomplished by the living cell. All of this leads to the conclusion that the influence of riboflavin upon superior plants is no longer a prospective problem from the standpoint of practical use.

VITAMIN B₆ (Pyridoxin or adermin). The structure of vitamin B₆ was established in 1939 by Stiller and Kuhn, working independently of each other.



Pyridoxin

As seen from the above formula, pyridoxin represents a product of pyridine. The physiological role of pyridoxin is practically unknown. According to Knight (1946), pyridoxin represents a co-enzyme of tyrosine-de-carboxylase. Knight's statements provide only the most general information concerning the role of pyridoxin in the metabolism of the vegetative cell.

This is equally true with regard to the work of the group of American authors (Lyman et al., (1946), who showed that pyridoxin exerts a favorable influence upon the growth of Streptococcus faecalis in cases when some amino acids are lacking in the nutritional medium. So long as the beneficial effect was increased considerably by the enrichment of the atmosphere with acetic acid, the authors expressed

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the opinion that pyridoxin may enter into enzymatic systems which participate in the fixation of acetic acid.

Simultaneously, a series of experiments point to the favorable effect of pyridoxin upon the growth of various plants. Thus White, for instance, who formerly was very sceptical about the necessity of using pyridoxin for the cultivation of isolated roots, later (1943) established that pyridoxin represents an effective addition to thiamin and glycine in growing the tips of tomato roots. Robbins and Bartley-Schmidt also observed the favorable effect of pyridoxin upon the growth of tomato roots. The above authors after testing various nutritional media came to the conclusion that the combination thiamine and pyridoxin will produce a noticeable increase in growth. (table 7).

Table 7

INFLUENCE OF B₁ AND B₆ UPON THE GROWTH OF CUT TOMATO ROOTS
(Robbins and Bartley, 1939)

Added to 50 cm ³ of nutrient solution	Weight of Root in mg (average from 5 roots)
Nothing.....	0.4
Thiamin 5 gamma.....	3.4
Thiamin 5 gamma + Vitamin B ₆ (1 gamma).....	16.1
Thiamin (5 gamma) + Vitamin B ₆ (5 gamma).....	
Vitamin B ₆ (1 gamma).....	15.7
Vitamin B ₆ (5 gamma).....	1.8
	1.3

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A similar conclusion with regard to tomato roots is made by Bonner and Deverian, and with respect to isolated carrot roots by Bonner (1940).

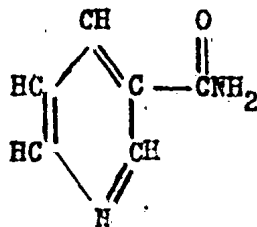
Judging from the results obtained by many students, pyridoxin exerts its greatest effects in combination with other growth factors, primarily thiamin and nicotinic acid. Attempts to use pyridoxin for stimulating the growth of normally vegetating superior plants were very infrequent and the results obtained from them contradictory. According to Bonner (1940), the introduction of pyridoxin into irrigation water (the experiments were conducted on sandy crops) increased the accumulation of the bulk of mustard. The greatest effect was produced by pyridoxin upon the growth of roots. A still more significant effect was obtained from additional feeding with pyridoxin of the plants cosmos and cotton. Other results were obtained by Minnum (1941) in experiments with sandy crops of radishes and cauliflower. In applying pure, crystallized preparations of different vitamins, including pyridoxin, as well as their combinations, the author did not observe any effect.

Thus the problem of using pyridoxin for practical purposes remained completely unsolved.

NICOTINIC ACID. The influence of nicotinic acid and several of its derivatives (especially the amide) upon the growth of microbes was established with complete certainty (Knight, 1937; Dorfman, Koser and Saunders, 1938; Smunders, Dorfman and Koser, 1941). Many pathogenic microbes react particularly well to nicotinic acid. Thus, for instance, almost all representatives of the intestinal typhus group do not develop

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at all when nicotinic acid is lacking, or show scanty growth. The study of the activity of various derivatives of nicotinic acid indicates that a favorable reaction was produced only by those derivatives which are easily converted into amides:



Amide of nicotinic acid.

The latter circumstance is explained by the fact that amide of nicotinic acid specifically enters into the composition of enzymes which fulfill a significant role in the oxidative-metabolic processes of living cells. As a part of the prosthetic group of enzymes dehydrase, the amide of nicotinic acid undergoes a reversible hydrogenation and dehydrogenation, which result in the transport of hydrogen.

The importance of a similar reaction permits us to consider nicotinic acid (in the form of its amide) as a necessary component of any cell. The reaction of any organism to nicotinic acid is therefore determined by the degree a given organism is capable in synthesizing this pyridinic derivative. As shown in the work of American students, chiefly Addicott and Bonner (1938); Addicott and Deverian (1939) Bonner and Addicott (1937 , 1939); Bonner (1940), nicotinic acid represents an essential factor for the cultivation of isolated roots of many plants.

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Table 8 serves as an illustration of the influence of nicotinic acid upon the growth of roots in a synthetic medium.

As seen in table 8, only a combination of thiamin and nicotinic acid supports the growth of pea tips with constant and sufficiently great rapidity. In a medium containing only one growth factor, the rapidity of growth drops from trial to trial.

EFFECTS OF THIAMIN AND NICOTINIC ACID UPON THE
GROWTH OF CUT TIPS OF PEA ROOTS (ADDICOTT, 1941)

Table 8

ADDED TO MEDIUM	RAPIDITY OF GROWTH IN CM IN A WEEK				
	5-10	6-10	7-10	8-10	9-10
Thiamin plus nicotinic acid.....	75.6	81.0	80.3	78.2	82.4
Thiamin.....	--	77.4	55.9	32.2	17.8
Nicotinic acid.....	--	79.1	59.8	22.2	8.2

*During the first 5 weeks roots were cultivated in a medium containing B₁ plus nicotinic acid.

It was subsequently established that roots get thin for lack of nicotinic acid.

Microscopic observations indicate that under those conditions the size and number of cells in the root are reduced; i. e., not only is the activity of the meristem disturbed, but also the growth of cells formed by it.

In considering the activity of nicotinic acid upon the growth of cut ends of roots, experiments were made for additional feeding with nicotinic acid of entire, normally photo-synthesizing plants. The

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majority of these experiments (see, for instance, the above mentioned work of Minnum, 1941) did not disclose any effect which undoubtedly testifies to the fact that green plants are capable of synthesizing under normal conditions the amounts of nicotinic acid essential for them.

It is evident that in the case of thiamin, the supply of nicotinic acid from the outside may produce results in the plant only at the moment of hetero-trophic feeding of the organism. In this connection it is necessary to dwell upon an interesting experiment conducted by K. E. Ovcharov, member of the Institute of Plant Physiology of the Academy of Sciences, performed jointly with his assistant Varzobskaja of the Mining Botanical Station M. I. Vavveev at Tadzhistan. The above scientists treated defoliated runners of Bokhara almond with solutions of nicotinic acid and obtained a rapid unfolding of buds and an accelerated growth of leaves. The results of these experiments are of decisive interest since they testify to the possibility of stimulating growth processes with the aid of nicotinic acid in superior plants as well.

We have hardly exhausted the group of additional factors of growth. Of undoubted interest among them are equally biotin, adenin, uracil and many others. The data presented above gives us, nevertheless, an opportunity to draw certain conclusions. The principal question which may be presented here consists in the following: wherein lies the exceptional activity of additional growth factors? Why do disappearingly small concentrations of these substances produce such exceptional effects?

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The solution of this problem lies in the field of the metabolism of the vegetative organism and the explanation of the role played by additional growth factors in this metabolism.

We have in our review continuously attempted to stress one peculiarity concerning additional growth factors. This peculiarity consists in that they all are components of some enzymatic system. This applies equally to those additional factors discussed in our review and the majority of those not reviewed here. They all enter into prosthetic groups of different enzymatic systems which evidently accounts for their high activity. Table 9 provides some understanding of this connection between enzymes and additional growth factors.

Table 9

ADDITIONAL GROWTH FACTORS - COMPONENTS OF
ENZYMATIC SYSTEMS (Haight, 1946)

ADDITIONAL GROWTH FACTOR	COMPONENTS OF SOME SYSTEM
Thiamin	Coccarboxylase; thiamin enzymes
Riboflavin	Various flavo-protein enzymes
Pyridoxin	Co-enzyme, tyrosindecaboxylase
Nicotinic acid	} Pyridin enzymes
Biotin	

This close connection between enzymes and "additional growth factors" undoubtedly deserves the most careful attention. It seems expedient to raise the question of a meaningful terminology for this group of substances in this connection, a terminology which should reflect the bio-chemical

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essence of these factors and would permit to draw a precise boundary between different metabolites. Terms used at present, such as "additional growth factors," "substances of the bios group," "undisputed metabolite," etc., are extremely inappropriate and fundamentally wrong. Is it possible, for instance, to consider thiamin an "additional growth factor" for organisms which are unable to exist without it? Or what is comprehended under the term "substances of the bios group"? It suffices to raise these questions to realize the vagueness and inaccuracy of these terms. Taking this into consideration we propose to name this group of substances "procoenzymes" (pro coferment). This term reflects the basic, unique characteristic of these substances, their connection with the enzymatic systems of the organism. The prefix "pro" indicates that these combinations represent an incomplete part of prosthetic groups of enzymatic systems. A similar term appears to us more convenient and appropriate than those used at the present time.

The second point upon which we consider it necessary to dwell concerns the reasons for the different reactions to organisms upon any procoenzymes. Above we have cited examples of similar distinctions among lower plants (see also Ierusalimskii, 1947). Here we shall therefore limit ourselves to only one illustration taken from the field of culture of isolated roots of different flowering plants. (Table 10).

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Table 10

NEED OF GROWTH SUBSTANCES BY ISOLATED ROOTS OF
DIFFERENT SPECIES (Bonner, 1940)

Need in growth substances	Thiamin	Thiamin and nicotinic acid	Thiamin and pyridoxin	Thiamin, nicotinic acid and pyridoxin
Species	Flax	Peas, radishes, alfalfa, clover, cotton	Carrots	Tomatoes, sunflower, thorn apple (<u>Datura</u> <u>stramonium</u>)

As seen from table 10, the isolated plant roots vary in their capacity to synthesize prococenzymes. While one of them (flax) is capable of providing for its essentials with the aid of thiamin, others (tomatoes, thorn apples, sunflowers) require the external introduction of an entire group of prococenzymes for their growth. A large number of examples can be quoted in this connection. It seems to us that a similar variety of the synthetic abilities of vegetative organisms is the result of an evolutionary process. The varied relation to prococenzymes not only by different species and varieties, but even individual clones within the limits of a variety, indicate the pronounced variability of this characteristic. Numerous facts in the field of microbiology testify to the adaptability of microbic cells in the process of a prolonged culturing with a lack of individual prococenzymes, which undoubtedly is connected with the acceleration of the synthesizing capacity of microbes with regard to these substances.

The intensification of the growth of cut root ends in the succeeding stages also speaks for the possibility of similar adaptation among superior plants.

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All this permits to consider procoenzymes to be a most effective weapon in the hands of a biologist, allowing for the influence upon the most varied stages in the life of a vegetative organism.

Simultaneously, the reviewed material provides the opportunity to express the supposition that the action of procoenzymes will be at its peak of effectiveness during the moments of the heterotrophic phase of nutrition of superior plants. The possibility is not precluded, for instance, that a pre-sowing treatment of seeds by the appropriate substance will contribute to more rapid germination. The combining of procoenzymes with synthetic substances of the type of heteroauxin also appears to be most expedient. The use of similar combinations in the vegetative propagation of plants appears to us particularly promising. One should consider that the application of procoenzymes must be based upon the detailed study of their need by a given organism. It is regrettable that similar studies are almost not being made at present with regard to superior plants, despite the fact that their importance is not disputed.

End of article

20 July 1951

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Transl. 195: Plant Protection

Principles of estimating losses
caused by field crop pests and
diseases. Zashch. Rast. 4: 12-29.
1935. 421 P942

Trans. by R. G. Dembo

In this article I intend to make a short survey of the methods of estimating losses caused by pests and diseases. The article is a preliminary information for a wider methodical handbook prepared for publication. Because of the width and complexity of the subject matter and of the small size of this article, the composition appears to be conspictive. Without repeating the ideas which were already discussed in my previous articles I will not illustrate again the degree of present backwardness in respect to the economic significance of pests nor the necessity of obtaining actual (not exaggerated or underestimated) data concerning their economic significance.

If at the present time the necessity of exact informations about the losses from pests and our unsatisfactory knowledge in this field are obvious to all the workers concerned with this field, yet the problem of finding the basic methodical principle for the solution of this problem is far from being solved. The opinion is widely spread that this problem could be solved by a centralized instructorship of an unprepared personnel. The latter would furnish information according to one method: The obtained information could be summed up by the central apparatus. Without denying the applicability of this method for some individual cases, especially in cases when we deal with a stable, widely spread and easily definable pest, we may question its general applicability. Its shortcomings are the following: 1) a huge

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amount of forms as soon as we try to include all pests; 2) the impossibility of obtaining numerous comparative data for pests which affect for a short time; 3) absence of sufficient knowledge concerning many pests.

This fact hampers in forming rational standard forms for registration;

4) the most essential - the impossibility of utilizing materials gathered according to a different method, especially of old materials. At the

same time, for the economic raioning data are necessary for 15-20 years,

therefore, a complete ignoring of old materials hampers the problem of

economic raioning. These considerations compel me to believe that

the problem of registering losses will still be mainly the problem for research and not only inspecting, and that it is still hard to solve

without two conditions: 1) high methodical preparation of the lower

personnel who would be able to understand independently the complex

phenomena and critically evaluate data which arrive in the correspondence;

2) the multiplicity of methods of approach for the mutual verification of deductions and for the possibility of summing up all the materials

obtained by various methods.

I will now discuss some basic ideas and will mention that by the term "pest" is understood animals and plants as well.

Losses: harm from pests expressed in money units, damage - in economic sense (counted on the field unit), harmfulness - for one plant or a part of a plant or upon a pest unit. Infestation - the presence of signs of the activity of the pest upon the plant or on a group of plants; disease - the presence of the pest itself.

The necessity of differentiating all these terms is important for the following reasons.

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The necessity of determining the losses is obvious during the calculation of the occurred harm, where there is no other unit except the monetary, and also in individual cases when it is impossible to find the damage in economic units; for instance, a slight deformation of the fruit form influences its export value, but often there is no economic loss. On the other hand, it is expedient to confine ourselves to the determination of losses and indicate damage in economic units, since there are cases where damage gives a better estimation of the economic significance of the pest than the loss: due to the fluctuation of product prices, the decrease of production might cause the increase of the cost of production and therefore we might have the impression that the pest does not have any economic significance which is wrong. It is clear that in these cases it is necessary to utilize some stabilized prices while for exported goods the prices have to be calculated according to those of the world market.

The differentiation of damage and harmfulness does not need any explanation. A series of pests indicate a direct damage, while others could be determined by their harmfulness and propagation. But even there, where the damage is possible directly, the definition of harmfulness is important for three purposes: 1) for the interpolation of data and the linking with the data of mass inspections; 2) for the forecast of the possible damage during the early phases of the pest development; 3) for the rating of potential damage. The harmfulness is expressed in percentage of crop decrease for a unit of infestation intensity or of the disease (the coefficient of Harmfulness)

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or the absolute infliction: the amount of production which could be damaged by one pest. In those cases when the harm is clearly defined and there is no proportion between intensity and harm, the coefficient of harm should be replaced by the principle of the dependence of the harm to the intensity.

Infestation and disease are not closely related. Infestation can not be higher than the disease, for instance in case of stinking smut [Billetia caries], when only a certain part of the infested plants show signs of infestation, or during the early stages of infestation by the Swedish fly [Oscinosoma frit], when the external signs were not manifested. On the contrary, the disease is higher than the infestation, for instance, for insects which transfer gradually from one plant to the other (spring owl [Apamea nicticans], locust), and in general in those cases where the pest abandoned the plant. It is more convenient to determine the harm according to disease since the disease is easier to determine and, as a rule, is kept longer than the infestation, but to be able to determine damage according to infestation is also necessary for the following reasons: 1) in those cases when the infestation does not manifest itself completely (stinking smut) the presence of a hidden harm is possible (Bortgardt) and the determination of harm according to disease would be smaller; 2) the determination of infestation is easily controlled in many cases against possible mistakes; 3) for the forecast of possible harm it is necessary to determine the damage from infestation.

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Thus, according to the degree of the problem, the ways of determining losses could vary: 1) a direct estimation of losses is done only in those cases when there is a qualitative damage, otherwise, the damage is estimated and multiplied by the cost of a product unit; such a division is expedient already because it is easy to reevaluate losses if there is a change in the product value; 2) a direct estimation of harm is easy when the entire plant has been destroyed (for instance, clearing from winter owl (Agrotis segetum)) or where the pest is distributed unevenly, but, as we shall see further, it is possible also in other more complicated cases; 3) during the diffused spreading of the pest, low infestation and comparatively constant harmfulness it would be more expedient to carry out the work by estimating the harmfulness (related to the unit of infestation intensity or to the disease) and the spreading of the pest.

During all means of explaining the problem there are specific difficulties, but at the same time, it is always possible to find means of overcoming those difficulties. Basic methodical difficulties are: 1) selectivity of pests; 2) the reaction to the damage and 3) irregularity in the distribution.

Selectivity in the broad meaning includes all cases of difference in the factual crops of uninfested plants or fields and the potential harvest of the diseased plants or fields, i.e. would be the harvest if the pest would be absent. It is necessary to differentiate; 1) the active selectivity, i.e. the actual (of course, unconscious) selection of plants by the pests; for instance, the Hessian fly almost does not lay its eggs on oats and, if it is able to select, it lays its eggs

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on the secondary stems; 2) passive selectivity, ~~which~~ the result which seems to be a selection, occurs only because of the absence of the definite plant. For instance, on winter crops the same Hessian fly infests very often mainly the first stems, possibly because during its flight the stems are reached only partly. For the active selectivity we may use the old term of selective ability, and the passive could be named differential effect.

The combination of these two different phenomena into one non-enclosure is expedient because: 1) we often are unable to determine without special detailed research which kind of selectivity was disclosed; 2) with the statistical cultivation of the materials the difference of these kinds of selectivity and the methodical principles of removing the camouflaged influence of both types of selectivity are essentially alike.

Besides the differentiation, the measures according to the degree of estimating the problem, we should also differentiate the degree of solving the problem. In my previous work I indicated three basic methods of research: analytical, questionnaire and expert. All the three methods have the right for existence, assist in improvement and supplement each other. In each of them is possible to differentiate approaches according to the degree of the problem.

The most perfect method which could be named the gradual-critical is divided into two basic directions: 1) topographical or the method of biological record which is applied not only for the direct determination of harmfulness, of the quantitative registration of pests and for the solution of a series of problems of ecological nature; 2) analytical method - by means of evaluating the harmfulness. The successive -

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critical method does not exclude the existence of other methods, but, on the contrary, should include it into one system. Of special importance is the method of questionnaire - the data of numerous correspondents; without those data it is impossible to carry out statistical regionalizing nor the filling of the intervals between data of comparatively few points with qualified observers. Here at the first place appear the problems of correcting the data obtained from various districts and their interpolation into one unified system. Finally, the expert method will be of great significance since the estimation of all pests is a process for many years. In spite of all its limitations, the expert method still furnishes a series of improvements. In its primary, unsatisfactory manner it represents a sketchy judgement of a person who had good experience in the given problem. His improvement goes along the following lines: 1) the increase of the number of independent experts; in selecting experts according to the territorial sign we proceed with the questionnaire method; 2) documentation of expert's proofs, not of a simple orienting opinion, but substantiating it by all available materials; 3) determination of the upper and lower limit of the damage.

The third point of view in classification of losses is that of national economy. Here we differentiate direct and indirect, actual and potential, liquidating and non liquidating losses. The definition of these terms is indicated in another work (Liubishchev, 1931 b).

In addition to the ideas expressed in that article, I will limit myself by indicating that while the problem of rating the actual losses permits

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only one decision, the problem of defining potential losses permits innumerable solutions. It is impossible to discuss potential losses from any pest in general; certain conditions have to be considered for the solution of that problem. For instance, in discussing locust, we may consider the potential losses by securing the farm structure during the complete end of control, or during the change of farm conditions, (cultivation of virgin soil, new methods of agrotechnics, planning, etc.) and the reservation of control, etc.

Finally, according to the artificiality and remoteness from production, we may differentiate experimental and field methods for the rating of losses. Here we have a wide scale of methods starting with purely experimental damages or artificial infestation of plants in vegetating vessels up to pure observation under undisturbed conditions. the transitions are: the method of model plants, method of isolated fields, method of field isolators (see Shchegolev, 1934). In all these cases the very fact of differentiating, noting and isolating causes unexpected changes in the conditions of plant sprouting.

Discussions concerning greater or minor value of the field and experimental method take place in all sciences. The widely spread opinion concerning the preference of experiment over the observation is in general void of sufficient evidence. The main reason for the transfer of scientific research to a higher position is the introduction of a qualitative approach to the study of phenomena; the significance of the experiment fluctuate depending on the concrete nature of the problem.

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For estimating losses the experimental method could not be leading, on account of a series of considerations: 1) diversity of factors which influence the harmfulness of the organisms, causes to build a great amount of combinations which makes the approach too clumsy; 2) the transfer from laboratories to productive conditions requires special work, since in the laboratory it is hard to create conditions similar to field conditions; 3) for many plants an artificial cultivation under laboratory conditions. Although in principle it is possible, but for technical reasons is not feasible (clover, perennial plants); 4) finally, a series of divisions of the general problem of estimating losses might be solved only by the field method, by theoretical extrapolation of the data of field observations and finally by complicated statistically-economic research. Here belong: quantitative registration of pests, its complications are often underestimated; the estimating of potential losses, when the experiment has a limited application, and in some cases inapplicable at all (hardly would any one recommend to stop the estimation of losses after the control is done); estimation of indirect losses etc. Therefore, I think that the experimental method is of great significance as a secondary one for the elucidation of such problems, where the application of the field method would bring us to our end only after a great experiment: 1) the solution of the problem concerning the presence of the positive effect in some complicated cases (for instance, the Swedish fly) and not just the selectivity of the pest; 2) the general theory of the reaction of plants upon the damage (the method of artificial damage); 3) specification of ecological relations etc.

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Topographical Method

The topographical method or the method of biological survey has not been sufficiently worked out and began to be applied only recently. Its advantages are numerous: 1) it may indicate data of damage directly without dividing it into elements; 2) it is indispensable for a mass application and does not require any special equipment. If, despite such advantages, the method did not acquire recognition (although the attempts of its application are of long duration), we could explain it by the fact that its advantages were underestimated and the difficulties overestimated. Its underestimation rested upon widely spread opinion that there is a comparative regularity in spreading of the majority of pests under specific ecological conditions which could be different only according to the number of the pest and could be compared according to other signs. But the comparison of ecologically different fields might cause great mistakes since we consider usually the difference which is explained by other factors. In reality an immediate study of pests indicates that as a rule the distribution of pests is uneven (examples are indicated in my article: "Is the Army of Pests Registered?" The Manual of VIZR (B H 3 P) * No. 3, 1932 and in the chapter "The Methods of quantitative Registration of Pests" which is under print; on the other hand, although the relation between the spreading of the pests and the ecological conditions is beyond any doubt, but it is of another nature than the relation between the harvest and the ecological conditions, and, desiring to determine

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the relation between the pests and the crops we are able to remove the camouflaging influence of selectivity by means of a thorough analysis. Besides, the same topographical method is an excellent measure for the study of ecological dependence of pests; by determining these relations we find the basis for extrapolation of the data of the observation point over the entire season. I will bring here a few examples.

Grushevoi applied the topographical method in fixing the harmfulness of the crown rust Puccinia coronifera; the disease and the crops decreased according to distance from the infestation source - forests with weeds of buckthorn Rhamnus cathartica. By this method the distribution of rust was determined by ecological conditions (the distance from the infestation source), but these ecological conditions did not influence or influenced the crops differently. Such influence can vary; for instance, the bushes of buckthorn could be found mainly upon low places of relief or the forest could cause the decrease of crops due to a highly developed root system (this has been found) etc. It is not hard to control this by means of registration by surveying the relief and other characteristics and by measuring the signs of the plant independent from the given pest. In case of rust they will be: the number of bushes to one field unit, bushiness, the height of plants before the appearance of rust etc. If these signs independent from rust will not indicate any systematic differences according to the distance from the infestation source, then we may explain the difference in crops by rust. But if any relation will be disclosed, then the research becomes more complicated and the solution of the problem

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might be found by comparing the fields found on the same distance from the forest, but which differ by the presence or absence of the basic source - buckthorn.

Basically, the topographical method (or the ecotopographical according to Hartzel', 1931) implies that all the examples taken are indicated on a plan, upon which are indicated some basic ecological data: relief, field boundaries, bounds, nearness of forests, rivers, ravines, etc. How many specimens should be taken, how to register them, which ecological signs should be taken - all this will vary in each concrete case and will depend upon the peculiarities of the studied object. The main methodical principles will be the following: 1) the direction of lines according to which the specimens are taken should result from our knowledge of the given pest; 2) where we expect a greater infestation the specimens should be more often, with a smaller infestation they might be more rare; 3) in determining the average infestation we take into consideration the distribution of specimens, but not the average figures. Let us have an example. We know that gophers live upon unploughed field with thin vegetation, along the roads, hills etc. Consequently, during inspection these signs should be indicated in the plan. In inspecting infestation of fields, we must draw perpendicular lines along the field boundary, close to the field, whereby the amount of specimens should decrease according to the distance from the boundary. Nevertheless, with the assistance of rare specimens the entire field should be covered from one end to the other (for instance, after 2-3 crossings of the field in the width of 3-5 meters), because, first of all some amount of gophers are also in the center of the field, and,

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second, they form sometimes large colonies in the center of the field. When we discover such a colony it is useful to inspect it in perpendicular direction with the aim of indicating its lines upon the blueprint. Of course, it would be absolutely incorrect to take just the arithmetical mean of our specimens and consider it as the typical infestation by gophers and their economic significance. The first is obtained by extrapolation of the obtained data from a field, the second - the combination of distribution of gophers and that of the crops. For the solution of the first problem the density of the gophers upon individual ecological fields: ravines, roads, hills, desert lands with heavy and rare vegetation etc. is determined. The relation between the density upon these fields and the distance is determined; such a relation could be a positive one-the plant attracts the gophers, negative one - due to the control in a related field. In the last case, we may extrapolate our data directly upon the close fields, in other cases this extrapolation may be sufficiently reliable only when a wide zone near the plant has been sufficiently inspected.

With the presence of positive or negative relation the amount of gophers will decline or increase according to the distance from the crop field until it will reach a definite level, where it will be stable, or will indicate uneven fluctuations. Only the data of this stable level could be indicated upon the field, the data from the field of the decreasing or of the increasing densities might be extrapolated into analogical zones in the given raion. This means the basic difference between the topographical approach and the generalization in taking specimens which was practiced until now. Until recently

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many workers considered pest registration mainly as the indication of the number, the distribution of specimens and the method of using them so that the average amount would indicate the clear idea concerning the amount of pests in the raion which is under inspection of the observation point. From our point of view, this approach is entirely incorrect: due to the irregularity in pest distribution the taking of specimens enable us to find the nature of the inspected field, but without any registration of the pest distribution on the inspected field no extrapolation is possible.

For the fixing of the economic significance of gophers or of other pests two surveys should be compared: the distribution of the pests and that of the crops. The relation between the amount of the pest and that of the crops indicates the data concerning loss if sufficient criticism is applied. I will explain by a few words how the amount of crops could be determined and what we consider a critical approach.

The amount of crops might be measured by the most variable methods depending upon the scale of research. If we, for instance, possess data concerning some large cereal Soviet farm of the size of tens of thousands of hectares, then we might operate with surveys on a rough scale, for instance on a scale of divisions of 400 hectares. Every division is characterized by infestation and crops (economical data) and those data are used for comparison. If the scale of inspection is more narrow, then it would be more expedient to apply another registration method for crops: by threshing individual fields according to zones (on different distances from the field boundary), if threshing equipment is available, or by observation of the combine work, if those necessary

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equipments are not available; the crop registration in the work with the combine might be accomplished by rating the amount of crops upon a specific field, for instance so many kilograms and liters (or some other measure unit) for a hundred meters or, on the contrary, by the distance at which the combines are filled with grain. Finally, with the most minute approach it is possible to register the distribution of separate holes and the distribution of crops (in specimens, for instance, upon one sq. meter) at definite distances from the hole. It is wrong to assume that we should give any preference to a specific method which would distinguish by its higher detail and more accuracy in rating. Each method has its merits and its shortcomings and the greatest dependability of our conclusions will be acquired when the results of various methods will be in harmony with each other.

According to the difference in methods by registering crops the comparison of both surveys and the nature of a critical utilization of data will differ. In general, both surveys could correspond and we should compare the crops and the infestation of the identical locations. But what do we mean by identical locations? If we take it literally, it means that the lines for the infestation specimens and for crops should correspond. This requirement is burdening (it is required either to indicate a great number of marks in the field or to hang lines with definite geodetic instrument) and often unnecessary. The degree of conformity of both specimens should correspond to the accuracy of our method. For instance, with a wide survey, each field is characterized by the average of several figures for infestation and one figure for crops. If we have a sufficient amount of inspected

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fields (for instance, 50-100), then every field is one "point" of biological survey. In inspecting according to zones, a "point" might be considered a field edge of the width of 25 meters and length of 100 meters and we compare the data for this "point" disregarding the place of the "point" where they were obtained. Only with the registration of the crops distribution near the individual hole, a definite mark with the indication of their quality is necessary: inhabited, abandoned, family, poisoned, etc.

When we use the critical approach we should, of course, take into consideration all the phenomena of the selectivity of pests (passive and active). For instance, it is known that the gophers prefer to settle along ravines, hills, but on the other hand, they avoid precipices, on the ploughed field they usually prefer unploughed parts, location with disrupted soil etc. Depending on natural-historical conditions this selectivity may be both positive and negative. For instance, unploughed, neglected parts of the field yield poor crops even without gophers in comparison to the rest of the field. Therefore, the simple comparison of crops in connection with the distance from the hole might give a mistaken idea of the harmfulness of gophers since all the differences in crops we shall explain by the gophers. On the contrary, if the ploughing of the virgin field continues, then the old fields might stand farther from the virgin field and consequently will be less infested than the new fields which, due to their freshness, will yield higher crops. In this instance, the loss will be camouflaged by controversial factors and we shall obtain low loss exponents. How could we avoid such mistakes? We shall need signs independent of the

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pest and the relation between the crops and natural-historical conditions. For instance, with the registration of crops around individual holes it is necessary to classify holes according to their characteristics: 1) their relation to the uncultivated soil etc.; 2) habitable and inhabitable condition. For each category of fields it is necessary to determine the difference in the average productivity: with a full absence of crops, for instance, on unploughed part of the field the typical amount and the frequency of loss; for places not inhabited by gophers or with uninhabited holes it is necessary to determine the character of harvest decrease from the center of the uncultivated field to its peripheries, and this curve of the decrease in the uninhabited field to compare with the curve of decrease in the inhabited field. This way we are able to remove the camouflaged influence of selectivity.

During the work at a larger scale, in comparing the infestation and the crops of various zones of the massive of different time of utilization, the degree of heterogeneity of the massive is determined by the evaluation of grass land in the localities not infested by gophers and by the determination of the average crops of spikes. With a sufficient amount of the massive it is possible to disclose places with varied settlements (i.e. in the boundaries of a field of homogeneous time length) which could be directly compared with each other.

The registration of topographical relations helps us in many cases to avoid wrong conclusions based upon insufficient critical application of variation statistics in mixing systematic and occasional mistakes.

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Let us give the following example (taken from concrete reality): the infestation of seeds of cauliflowers by bacteriosis appeared to be considerably higher for mulched plants than for unmulched plants and the difference is absolutely authentic. Is it possible to conclude that mulching assists in infestation? The study of topographic relations helps in solving this problem. If the mulched lots would alternate with the unmulched lots and would indicate a statistically authentic difference, then the hypothesis of the influence of mulching would be possible to consider substantiated (without solving the problem whether the mulching influences by itself or because of special conditions). In reality there is an unmulched field along with the mulched one. Therefore, individual mulched plants could not be considered independent repetitions, but are connected parts of the same evidence. The study of the infestation locality indicates that we have a gradual increase of infestation from one end to the other and that the zone of unmulched field which is close to the mulched one does not manifest any difference in infestation. The inspection of topographical relations rejects with complete safety the hypothesis which seemed possible without registration of distribution of specimens.

Definition of Harmfulness

The definition of harmfulness is necessary when a direct definition of harm appears to be too clumsy, difficult to realize due to the relative regularity in the spreading and to the relation with ecological conditions. But this is beneficial also when there is a full possibility of direct definition of damage by the topographical method. In such case, the damage is defined indirectly by the means of registering

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the spreading of pests. The expediency of such a definition is clear; knowing the harmfulness and the amount of the pest we are able to define the potential damage.

Until recently the definition of damage by harmfulness was considered the most reliable measure, and the basic method of definition of harmfulness was considered the method of vegetative vessels. We indicated above the principal objections against the vegetative method. A closer study of individual work on definition of harmfulness convinces us in the same: the vegetative method does not furnish that accuracy of results claimed by its supporters. A detailed discussion of this work will have to be postponed due to lack of place.

But if we consider the field method as the best for definition of harmfulness, then we must eliminate all the shortcomings which are inherent in it and make it not less reliable and accurate than the vegetative method.

The basic quality of the vegetative method is the fact that infested and not infested plants are alike in everything before infestation or before the disease; the fact of infestation or of disease causes the only difference and, consequently, the difference in yield could be explained by this distinction. In field conditions there is no such a comparison, because, due to the selectivity at the moment of infestation, the infested plants and those uninfested are different and, therefore, as a rule, the future yield is not identical. But it is quite obvious that we are able to obtain comparative plants if we shall select plants within the boundaries of homogeneous category according to the sign irrelevant as to the pest. Kurdiunov was one of

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the first among the advocates of that method who, for the definition of harmfulness of the grain saw fly Trachelus tabidus, compared not simply the weight of infested and uninfested stems, but of stems whose length is similar. With a gradual development this method adds up to the comparison not of separate groups of stems, but of lines (so called the lines of regression) of the relation between the yield characteristics (weight of the grains, the average weight of one grain, the amount of grains, etc.) and the characteristic independent from the pest. This way we arrive at a definite coefficient of harmfulness in comparison with the primary, the rough one.

But is one definition of a coefficient of harmfulness sufficient by which are based upon one independent principle? Definitely not, because we often must verify whether the independent characteristic is really independent from the pest. For instance, in case with the grain saw fly Murdinov takes the length of spike as the independent characteristic. But are we sure that the larva of the saw fly does not influence the length of the spike? For the solution of similar problems the formation of new lines of regression between the characteristics which cause any doubt in its independence (for instance, the number of spikes in general, the number of developed spikes, etc.). Only in case of their actual independence, the lines of regression for any pair of such characteristics will be identical for the infested and uninfested stems, although the arithmetical means, due to selectivity, may not coincide. Therefore the coinciding lines could be considered as a proof for independence.

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Another possible source for mistakes might be the circumstance that we did not consider entirely the selectivity of the pest. For instance, in my work on the grain saw fly (Liubishchev, 1931) a simple comparison of lines of regression according to a characteristic independent from the pest (the thickness of stems, the length of the spike) did not remove the camouflaging influence of selectivity until another type of selectivity- the disease of the first stems - has been removed. Then could we be assured that the selectivity is exhausted? We will exhaust it when all the methods will produce the same results. In the mentioned case of the saw fly, the presence of one mistake during the first stage of work is clear from the fact that the application of various methods of rating the coefficient of harmfulness resulted in drastic fluctuations of the obtained amount.

Finally, the research could be considered completed when, besides of obtaining a series of noncontradictory exponents, we sum up our data in complete agreement with all our knowledge of pathology and physiology of the diseased plant. Of course, if based on our well analyzed data we come to a result which contradicts our data accepted in contemporary plant physiology, then it does not mean that our data were wrong: the mistake might be on the part of physiology; but until we verify the contradictory affirmations of physiology we must consider the question still unsolved.

This methodology has been worked out in many cases. Sometimes it leads to a quick satisfactory solution of the problem, for instance, in case with the rye thick fly, Isosoma noxiale, (see Medlakov, 1932) or with clover weevil (unpublished data of N. A. Vasil'ev). In other cases

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the work is complicated, but finally it leads to our end (see cereal saw flies, A. Liubishchev, 1931 and unpublished data of V. N. Makalovskaya, European corn borer Pyrausta nubilalis, according to unpublished data V. I. Talitskii, flax rust according to data prepared for collection N. V. Nesterova). There are, of course, cases when this method does not lead to a definite solution because we may find a layer of various generations of the pest of uneven harm (unpublished data of N. G. Titov concerning the Hessian fly). In this case (for instance, the size of the cocoon) it is impossible to define the harmfulness of each generation separately. Since it is impossible, we should consider the fluctuation of the obtained coefficients as a data because it indicates the real fluctuation of the phenomenon.

The above indicated general method of comparing the lines of regression in its primary stage (obtaining data during the moment of harvest) could seem inapplicable for pests which infest the plant early and which causes such a deep change in the plant that at the moment of harvest no sign is left disregarding the pest. This we have, for instance, during early infestations of the Swedish and Hessian flies.

Yet, the method of regression lines is applicable, but only in applying model plants which we observe from the very beginning of vegetation. Here we notice signs independent from the pest, for instance, the time of sprouting (counting by twenty-four hours or part of the twenty-four hours) the number of leaves before the infestation by the Swedish fly (the beginning of infestation could be determined by analyzing the plants which are in the vicinity) the length of the

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longest leaf etc. This way we are able to determine the selectivity of the Swedish fly and to avoid its camouflaging influence by means of comparing the lines of regression of harvest data, according to signs determined before the infestation by the Swedish fly. This measure, of course, is inconvenient and, possibly, for the Swedish fly it would be possible to reach the end by means of applying the topographical approach.

Finally, when we determine harmfulness, we should take into consideration the possibility of compensation of the damage by the development of undiseased parts or plants. In these cases when the compensation occurs within the plant itself (for instance, new stems to replace the destroyed ones) and the harm should be determined not by the stem, but by the plant. But with infestation of the entire plant (for instance, the Hessian fly upon winter crops, or dry smut) the reaction of neighboring plants which compensate the harvest is possible. The determination of this compensatory reaction differs in its difficulty according to the phenomenon whether the traces of the diseased plant are preserved during the moment of harvest or not. The first case we have, for instance, with the dry smut. In this case the presence of compensation could be determined by means of studying the relationship between the harvest of individual plants according to the remoteness from the diseased plant. It is clear that, if compensation takes place, then the plants near the diseased ones would yield higher crops than the remote ones; but if there is no difference, then, we have no right to speak about compensation.

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For the Hessian fly upon winter crops we have another, more complicated case: at the time of harvest, as a rule, no trace remains from the plant which died during the winter. But in this case, the death of the plants occur so early that the influence of the death due to the Hessian fly could be compared to any other factor (unlike the smut when the plant lives long and ceases to assimilate shortly before the ripening of the spike). Therefore, the influence of the blanks in grass field could be determined. Or we could determine the dependence of the average harvest of one plant from the amount of the number of the remained plants upon a definite field - 10, 15 or 30 running cm. By this measure we may determine quite accurately the harmfulness of similar pests and those corrections in compensation which we have to allow during various degrees of infestation. Since for the same Hessian fly on winter crops we may determine the damage by the topographical method or by utilizing the material according to terms of sowing with the corresponding cultivation (the camouflaged influence of the terms of sowing could be removed by the introduction of coefficients of correlation), then the problem of selecting the method of research is solved by examining concrete data and in relation to time and means at our disposal.

Therefore, depending upon the peculiarities of the pest, it is necessary to modify the method of study its damage and harmfulness. In order to prove the variety of pests from this methodical point of view, it is sufficient to indicate that we are able to perform this division by various means. We are able to differentiate: 1) the primary pests, the ones which infest the sound plant, and the secondary,

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the ones which infest the diseased plant: 2) diffused ones which spread comparatively evenly, and contrasting ones which are spread unevenly; 3) with one type of damage or with several types of damage; 4) with permanent or alternate intensity of infestation; 5) direct ones which damage the harvest directly, and indirect ones which affect through the vegetating organs (it is not necessary to confuse with direct and indirect losses); 6) pest which damage in their early and late stages; 7) slowly moving and fast moving; 8) pests which leave behind conspicuous traces of their activity and the ones which don't leave any traces; 9) pests which cause obvious damage or hidden; 10) with the presence or selectivity, fluctuating selectivity or without any selectivity etc.

These characteristics could often combine with each other in such a manner that we obtain a considerable amount of combinations whereby the methodical variety of damage increases correspondingly. Therefore, during the study of the economic significance of pest it is necessary to determine its pertaining to some division according to the signs and to outline a plan for research accordingly. To indicate the method of determining harmfulness, without taking into consideration the peculiarities of the pest, this means to formulate such a huge scheme which would be hard to figure out and to apply, and it would require tremendous work and means for its fulfillment.

During the determination of the coefficient of harmfulness it would be impossible to forecast all possible combinations of factors which influence the harmfulness: it is necessary to choose combinations

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which are more frequent. This approach will be successful depending on the degree of our familiarity with the pest and, of course, according to the investigator's experience. According to all these data, the result will be of more or less clearness.

The Definition of Losses

The problem of defining losses is a synthetic one - the drawing of a picture of the economic significance of the pests based upon individual elements of observation. We must include here all data of defining harmfulness, damage and the distribution of the pests: all the mass research materials obtained by the inquiry method should be connected with the above data and the regionalizing, the pest in locality and in time should be rated; not only the maps of its spreading, but the frequency of its mass manifestations. Therefore the entire problem, besides of the discussed one is divided into four basic parts: 1) the quantitative registration of the pest: if the definition of damage is found by the topographical method, then this problem is solved simultaneously, but if we define it by harmfulness then an independent definition should be found; 2) tying up data which are obtained by a specially prepared personnel with mass data obtained by the inquiry method; this problem includes the introduction of correctives into the data of mass correspondents, extrapolation and interpolation of data; 3) the regionalizing of the pest which is divided into several parts (we shall mention this below); 4) the general synthesis of losses.

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1. The quantitative registration of pests.--The basic difficulty of the quantitative registration of pests is the irregularity of the distribution of pest even in the boundaries of even ecological conditions or under ecological conditions which practically seem to be elusive. These difficulties could be overcome only by the topographical method and by the study of the structure of the pest distribution. The chapter "The method of quantitative registration of pests" (in my book under print "The methodology of pest registration" with the assistance of M. I. Kosobutskii and I. P. Stepanov) will furnish the details, and here I will just indicate that this study of the structure is carried out by three basic methods: 1) determination of correlation of infestation of neighboring fields under various scales; 2) defining the coefficient of distribution under variable size of specimens; 3) comparison of the distribution of empirical and theoretical curves. Such a study will permit to determine the degree of deviation from the statistically uniformed and furnishes the basis for such an approach for the distribution of and taking specimens. This way we reach a conclusion which is obtained on the observation field of the entire raion.

2. Linking, extrapolation and interpolation of data.--Extrapolation is understood here as the judgement of losses in the entire raion based upon data of one observation point, under interpolation we understand the counting of temporary data between neighboring observation points and the points of mass observations. In those cases where all data furnish an even picture of gradual changes of degree of infestation and of disease (for instance, on the maps of diseases from winter owl,

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data of I. N. Filip'ev), interpolation does not represent any difficulties and the picture could be considered quite reliable. But if we have drastic differences or jumping fluctuations, then we need a critical analysis of the obtained materials. There might be various cases. The first one, and the simplest, consists of systematic difference (increase or decrease) of data of mass correspondents in comparison with the data of a special personnel. The reason for a difference could be realistic (for instance, if the observation points are located at old experimental stations, and the mass correspondents acquire their informations from newly constructed Soviet and collective farms) or is explained by mistakes of mass observers. An itinerary observation of a few locations by the personnel of observation points will assist in finding the causes for differences and to make corresponding conclusions. Thus, if the testing indicates the reality of the differences, then, the data of the observation points could be generalized only by the regional fields, for mass conclusions the data of the correspondents should be used. Often there is a difference based on inaccuracy of observations; the correspondents either do not pay attention to the pest or, on the contrary, confuse it with other pests and overestimate its significance. The reason for such an overestimation is often simply the camouflaging of agricultural shortcomings which caused a poor sprouting, the development of weeds etc. After having defined the presence of underestimation or overestimation it is possible to introduce corresponding corrections into the mass data. A more frequent case - the drastic fluctuation of data. Here also might be cases of real fluctuation of pests or it is

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based upon an insufficient attention of some correspondents. Here the problem is determined by observation of several locations, for instance, the itinerary between two points, of which one indicates the absence of the pest, the other indicates its presence. In case the visit of such "empty" point would disclose the pest and such a result would repeat itself we have the full right of indicating the infestation upon the "empty" points as well. Such a case occurs with smut. This disease is spread quite regularly and therefore the difference between infested and non-infested fields is basically provisory: depending on the assumption which percentage of infestation we would consider uninfested. In the given case, even without inspection we may spread data of approbations for those fields where there was no approbation or informations are not available, and we should not proceed as we used to, for instance, to consider all fields which were not under observation as not infested. On the contrary, if the observation will manifest a real drastic difference in infesting the neighboring points, then the itinerary will permit to indicate whether we deal here with the attachment of the pest to definite ecological conditions or with the nidi distribution of the pests. In the first case we are able to extrapolate our data according to corresponding ecological differences, in the second case to study the structure of the distribution of the pest (the size of the nests, their location, etc.). In case this problem would be too complicated, then we will find the average infestation, but with the indication of the fluctuations and with the fixing of any shortcomings in any direction. This is achieved by the method that for the fixing of the lower boundary we discuss all points

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from where we do not have any informations whether it does not disclose any of this pest, but for the definition of the main boundary we shall spread data obtained from the points of observations to those locations where no informations were available.

3. Regionalizing-- The general problem of economic regionalizing is divided into the following parts: a) statistical regionalizing i.e. the indication of the basic zones of the harmfulness of the pest by means of utilizing many informations concerning their appearance. Such maps exist in american literature, partly also in our country; thus, Troitskii used the data of 34 years published under "The year in agriculture" for the draft of a map of winter owlet (Agrotis segetum, (see H. H. Troitskii, 1922); I prepared a map for the Hessian fly (under print). Such maps indicate purely empirical regularity with formulate and are in need of corresponding theoretical foundations; b) regionalizing the harmfulness is a problem in itself. The first regionalizing is based upon the summary of questionnaire materials, and it does not reach any quantitative conclusions in respect to the harmfulness of the pest. In several points the harmfulness of the pest is determined. In many cases several definitions provide clear differentiations of harmfulness according to raion(s) (for instance, for the Hessian fly upon spring crops in the Ukraine the harmfulness is considerably higher than in Northern Caucasus), but, of course, a few points are sufficient to indicate general regionalization of harmfulness. This can be determined after having evaluated the relation between the harmfulness and the complexity of ecological conditions. We now arrive at the third problem-- c) the theory of the distribution of the pest. Regionalizing would not

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be complete until we give a theoretical interpretation of indicated distribution and until we indicate the satisfactory quantitative correlation between the theoretical lines indicated by us and the empirical data. Such theoretical accomplishment provides an assurance in the dependability of our conclusions and will assist to carry out our work by a more economic manner. Finally such work is of great significance against quarantine pests: the fixing of zones of potential harm of a pest which was not yet imported. Attempts for such theoretical maps is available in foreign literature.

The construction of such a theory requires, first, fixing the dependence of the pest and of its harmfulness on a series of conditions, and second, to find the dependence in production. For the first determination the experimental method will be beneficial in many cases, for the concrete data which were first used as hypothesis during the analysis of field conditions; the work of IA. I. Prints could be a good example of such application of the experiment. As to the consideration of determined relations in production, we face here some serious technical complications consisting in the necessity of a radical reconsideration of the available meteorological data. The regionalization of the pest, of course, depends mainly on temperature and moisture during specific phases in the development of the pest; but regionalizing the harmfulness depends on the character of phenology of the pest and the plant. Therefore, even if we admit that the character of dependence is determined correctly, we are unable to utilize the isolated lines of usual meteorological atlases, except under minimum and maximum temperature, because those lines are constructed according to calendar data

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and not according to phenological data. On the other hand, the relation between individual pests vary. For some, the time of temperature's increase is important, for others, as with the grape mildew, the definite combination of minimum and average temperature with a definite quantity of rainfall. Therefore, often in observing meteorological stations, we either don't find any similar data or their rating is a complicated performance. Therefore, it is not surprising that such maps which fulfill strict requirements are not available. Nevertheless, the practical significance of the problem does not permit us to retreat on account of these difficulties.

4. The general synthesis of losses.-- The simplest method of synthesis of losses is the acquisition of effects of harmfulness upon the spreading and cost of one unit of production. In determining the average damage the average amount of losses is taken (or recommended) and it is multiplied by the average yielding capacity. Of course, such a measure could be applied as first approach. But, since the harmfulness is often connected with the amount of the possible yield, we may commit error. Here is an example: the Swedish fly is known for its specific harmfulness under poor conditions of sprouting during the first period of vegetation; in such cases it is able to destroy the harvest completely, but without the Swedish fly under the same conditions the harvest might be slight. For instance, with a good development of the plants even a hundred percent infestation might have no influence upon the crops. Therefore, we may construct such a table, although artificial, but which corresponds to general real relations (in all cases the hundred percent of infestation is taken into consideration, hence the infestation and the damage coincide):

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	Average			
Potential yield without the Swedish fly (in centners)	1	10	20	10.3
Harmfulness (in percent)	100	20	0	40
Factual yield (in centners)	0	8	20	9.3

Thus, the average decrease of yield during these three years consists of one centner from hectare or 9.3 percent of the possible harvest for three years; meanwhile, if we multiply the average harmfulness by the average potential harvest, we obtain a decrease of 4.12 centners or more four times the real one; the mistake, as we see, is not small. The general method to avoid similar mistakes is to obtain average figures according to the potential yield.

I will limit myself to these short considerations. The problem of rating the secondary and potential losses will be put aside: here the methodical work is still in more backward condition than in respect to direct actual losses. As to the category of eradicating and non-eradicating losses, the boundary between them varies depending upon the perfection of the control methods. Before we obtain definite informations in respect to actual and potential losses the determination of eradicating losses could be performed by the expert method.

Expert Method

As it has been indicated, the acquisition of definite informations in regard to losses of the majority of pests occupies some time and requires an important, specially prepared personnel. And since production requires on the part of research organizations some indications of harm from the pest then the expert method has the right for existence. Such a critical expertise might provide a reliable, although inaccurate

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answer by means of coordinating various data. For instance, for the denial of the theory "white spot" it is not necessary to wait until the problem of harmfulness of the Swedish fly will be solved in all its accuracy. The comparison of data: 1) decrease of wheat sowing during the last decades after the development of railways; 2) a higher yield capacity of wheat in this raion in comparison with Southeast; 3) the absence of correlation between the yield and the percentage of infested bushes which indicates that the amount of the Swedish fly does not by itself influence the yield etc.. The given hypothesis is absolutely incompatible with the factual material. A more circumstantial analysis (see Sbornik VIZR No. 7, 1933 and the circumstantial article, along with M. IA. Kozlova, sent to print) discloses the causes for errors, and the coordination of all results permits us to reject the regionalizing influence of the Swedish fly, although its economic significance remains indefinite.

A good example of the application of the critical expert method is the work of M. T. Aristov along the economic significance of apple flower eater (Anthonomus pomorum, see M. T. Aristov, 1932), and also a series of work of German authors. The harm of Anthonomus remains indefinite, but by comparison of all data we are able to determine the density of harm and to regionalize its practical significance.

Finally, as an example of a more indefinite expertise I will indicate my ratings according to general losses from gophers and locust (Liubishchev, 1933). Here we proceed with the expert evaluation, analyze it, indicate the availability of errors and their minimum significance and arrive at the boundary of the potential damage.

In this article I was forced to abstain from the analysis of concrete data and to discuss the available literature only superficially. But I do hope that, in spite of the complexity and the multiplicity of the problems connected with the evaluation of the economic significance of pests, the matter is not hopelessly complicated and with the efforts of all workers the problem might be solved successfully.

Summary

1. The complexity of the problem of the economy of pests requires a high preparation of the personnel and the utilization of all various ways of solving the problem.

2. The means of study the problem of losses vary: a) according to the character of division of the problem into elements (damage, harmfulness, disease, infestation, etc.); b) according to the degree of the accuracy of approach: gradually-critical, questionnaire and expert methods; c) according to national-economic point of view; d) according to the degree of artificial method.

3. In production we must pay special attention to the application of the topographical method. Its shortcomings and camouflaged influence might be removed by introducing supplemented signs and by a critical discussion of topographical relations. Without the registration of topographical relations it is easy to commit an error by taking parts of one repetition for individual repetitions.

4. During the definition of harmfulness by the field method quite reliable results could be obtained by observing three basic methodical requirements: a) comparison of the line of regression

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according to the sign independent of the pest; b) agreement of data obtained by various independent methods; c) agreement of data with our knowledge according to the physiology of plants.

5. The definition of losses, besides the immediate registration of harmfulness, includes the divisions: a) the quantitative registration of pests (according to the topographical method simultaneously with the definition of damage; b) connections, extrapolations, and interpolations of data of the field with the data of the presented region; c) regionalizing which is divided into three parts: statistical regionalizing, regionalizing of harmfulness and the theory of zone divisions; d) synthesis of losses only during the first approach which could be replaced by a simple multiplication of elements.

6. The expert method will for a long time preserve its significance, but, if we apply during the expertise all our data and by coordinating it into a unified noncontradictory system, we may obtain conclusions which are reliable and which could be of practical significance.

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The Department of Genetics and of Cytology (p. 224-232)

The Department of Genetics exists in the Timiriachev Agriculture Academy since 1929 only. This is due to the fact that genetics is only 3-4 decades old. In our country the science of genetics started to exist only after the October Socialist Revolution.

The Department of Genetics and of Selection has been organized in the Academy after the October Revolution, and it existed in such a form until 1927 (the year of death of the chairman of the department S. I. Zhigalov). In 1929 the Department of Genetics and of Selection was divided into two departments: Department of Genetics and of Cytology and the Department of Selection and of Seed Growing. The formation of the Department of Genetics and of Cytology took place in 1931 when A. R. Zhebrak (active member of the Academy of Sciences of BSSR) has been appointed the supervisor of the department.

Before 1937 the scientific work has been carried out only with the groups of students who specialized in selection and in seed growing. From 1937 the course of Genetics with some elements of Cytology has been introduced into all divisions of field and vegetable production departments.

The curriculum of the department consists of lectures and of laboratory work on Genetics and on Cytology during the winter, and additional practical studies during the summer. The studies in Genetics consist of discussion on crossing, on herbarium of beans and wheat, and also of individual experiments by students on the

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Drosophila. In the *Drosophila* experiments the students study the uniformity of hybrids of the first generation, splitting in the second generation, the law of the independent splitting of characters caused by genes localized in various pairs of chromosomes, and also heredity signs of sex. During the summer studies the students acquire the methods and the technic of crossing legumes and cereals and become acquainted with the elements of genetic analysis of vegetative material in the field and in the vegetative house. The cytological work aims to acquaint the students with the technical preparation of cytological equipment and of the study of basic stages in cell division, and also the survey of cytological equipment of various agricultural plants.

The staff of the Department of Genetics carries on research from the very start of its organization. In 1934 the department solved the problem of the interrelation between phenotypical changes and the changes in genotype. This problem is of great methodological significance. Until then the opinion prevailed in literature that the genotypical processes do not depend on the changes of the phenotype. It has been determined by the Department of Genetics that even slight phenotypical changes which are caused by the aging of the organisms, by temperature etc. influence the processes which occur in the genotype. The conclusions along these studies are new in genetic literature and were discussed in a doctor's dissertation presented by A. R. Zhebrak in 1936. Two experimental works on this problem were published in the "Bulletin of Academy of Sciences".

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The second problem which has been discussed in the department-- is that of mutual influence of graft upon wilding in grass plants. This problem has been discussed by I. V. Michurin. After Michurin's research the department applied the method of transplantation of grass as the method of vegetative approach of various species and genera. After having carried out a great amount of experiments in grafting for the purpose of crossing beans, lupinus, vicia, soy bean, vicia faba, lentils and other plants, the department did not obtain any hybrid seeds of peas with all the indicated species and genera of the legume family. There were not obtained any hybrid seeds from crossing peas with other species and genera of legumes without grafting. In the process of study the character of grafting development it has been determined that a series of phenotypical signs under the influence of grafting is changing. Based on these results the department came to the conclusion that during transplantation various changes of phenotypical kind occur which could be caused by other factors of the environment, but during transplantation changes which would produce the crossing of these genera did not manifest themselves. During transplantation vegetative hybrids do not occur according to many authors who carry out such experiments with other grasses, because for the formation of the vegetative hybrid the blending of two somatic cells and the formation of a new organism with the chromosomes of both grafted components are necessary. Three works of A. R. Zhebrak on this topic have been published in various editions and one work is prepared for publication by the assistant A. A. Fedorov.

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The next question studied in the department is that of the nature of the effect of interspecies crossings with autopollinated plants. The experimental stations of the Union are working and worked during recent several years on that problem. The experiments of the department were carried out with peas and wheat. The department considers the experiments with peas as completed. The obtained experimental data indicate that the effect from interspecies crossing sums up to modified changes which disappear after 1-2 generations. Usually the seed material obtained from interspecies crossing propagate under best agrotechnical conditions. These seeds are of higher weight and of better nourishing qualities. Therefore, by sowing such seeds the breed is better than by usual seeds sown in inferior agrotechnical environment and we acquire an impression of a positive significance of interspecies crossing. In reality the effect of interspecies crossing results in a better raising of plants obtained from seeds of interspecies crossing. In its experiments the department aspired for a similar raising of the experimental and control material and did not disclose any effect from interspecies crossing. This conclusion corresponds to the data of other authors on other plants.

The study of a long inbreeding is also quite important. During the process of working out this topic it has been determined that during a long inbreed the processes in genotype are different from that without inbreed (candidate dissertation of A. A. Fedorov).

The department studied the problem of inheritance in the length of the vegetative period of peas. The practical result of this work is expressed by the fact that new speedy pea species were acquired.

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According to the decree of the Committee on higher learning and the People's Commissariat of Agriculture of USSR the Timiriazev Agricultural Academy has the task of raising immune species of winter and spring wheat for the oblast's of nonblack soil. This problem could be solved by hybridization of various species of wheat and by obtaining new breedings in the process of mutation. The most effective method, according to the department is a remote hybridization, i.e. the crossing of various species of wheat and the crossing of wheat with other grain products of close genera. It is necessary to use the crossing of various species of wheat, because many valuable qualities of wheat are spread among various species. The combination of these qualities in one species is possible only by hybridization.

The department of Genetics shifted recently over to the work with wheat. This could be explained by the fact that wheat is the most important agricultural plant manifested by various species, with a varied number of chromosomes. Therefore, the interspecies crossings are interesting not only in solving a series of practical problems, but also in general theoretical sense since they enable us to grasp the evolution of the most important agricultural plant, wheat.

All species of wheat, as it is known, are divided according to the number of chromosomes into three main groups: 14-chromosomes, 28-chromosomes and 42-chromosomes. The number of chromosomes are strictly constant for each species and it can exist only with the presence of a definite number of chromosomes.

Therefore, the number of chromosomes are the most essential distinctive peculiarities of the species of plants and of animals.

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That is why the geneticists search intensively for various methods by which it would be possible to increase the number of chromosomes in plants and first of all in crops.

According to contemporary genetic-evolutionary opinions, all species of wheat originated from a common ancestor. Nevertheless, the boundaries between various chromosome groups of wheat and species are quite real and are easily disclosed in the process of crossing. Thus, for instance, by crossing the wheat species with 14 chromosomes with species of 28 and 42 chromosomes we obtain hybrids almost entirely sterile. By crossing the species of 28 chromosomes with the species of 42 chromosomes we obtain either sterile or slightly fertile hybrids. Consequently, the number of chromosomes is the real indicator of the boundary between species. This fact confirms the conclusions of contemporary classical genetics about the special role of chromosomes in the process of inheritance. It is true, not only the number of chromosomes are the signs of the species boundaries, but the structure of the latter as well, because within the boundaries of the 28 chromosome group are ^{of} various species and some of them, even with the equal number of chromosomes, differentiate considerably. Thus, for instance, Timofeev wheat with equal number of chromosomes crossing with other species of the same group result into highly sterile hybrids.

In practical sense this species of wheat is of special interest for selection, because it is characterized by the immunity to many wheat diseases and pests. It is known that wheat diseases and pests cause considerable damage to agriculture. According to data of the expedition of the All-Union Institute of Plant Production, the loss

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from rust alone reaches 10 percent of the grain yield. Therefore, the raising of immune wheat species is a most important problem. The solution of this problem is possible by crossing cultivated wheat species with the Timofeev wheat. Nevertheless, this problem could not be solved until recently by hybridization with Tr. Timopheevi because this species is genetically different from other species and produces hybrids highly sterile. In order to include Tr. Timopheevi into the selective process it is necessary first of all to solve the theoretical problem in restoring the fertility of hybrids of the first generation between Tr. Timopheevi and hard and soft wheat. The individual seeds obtained from the hybrids of the first generation do not solve the problem of the synthesis of new wheat species because in such plants the process of further splitting into other species occurs. In the following generations either "pure" hard and soft wheat breed or Tr. Timopheevi. The latter is the result of the absence of homology of chromosome complexes of these species and this hinders the combining valuable qualities of one species with valuable qualities of the other species. The solution of this problem is possible only by means of overcoming the sterility of hybrids and of the synthesis of a new wheat species which combines the complex qualities of basic parent species.

Facts were observed in genetics when by doubling the number of chromosomes with highly sterile hybrids their fertility is restored. Such a doubling of the number of chromosomes in sterile hybrids occurred often and caused the restoration of fertility. Therefore the problem of restoration of fertility could easily be solved by doubling the number of chromosomes. Since already at the beginning

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of A. R. Zhebrak's work in 1936 it became known that the hybrids of hard and of soft wheat with Triticum Timopheevi are sterile, A. R. Zhebrak, when starting these crossings, simultaneously discussed the problem of the doubling the number of chromosomes within these hybrids in order to restore their fertility. Starting with 1936, began a persistent search for methods to restore the fertility of highly sterile hybrids of wheat by doubling the number of chromosomes since this is the only method of obtaining fertile species. For this purpose the effect of high and of low temperature was tested. These tests were done before by American authors to obtain polyploids within corn and in other plants. But the method of temperature effects used by A. R. Zhebrak with the purpose of obtaining amphidiploids in the hybrids of hard wheat with the wheat of Timofeev did not give positive results. This fact could be explained by the fact that the experiment was not carried out on a sufficiently large scale.

The work of American authors Blakeslee and Avery published in 1937 on the application of colchicin aiming to increase the number of chromosomes in plants attracted the attention of many geneticists of USSR including those of the department. In 1938 the department had the hybrid seeds of the following combinations: Tr. durum X Tr. Timopheev, Tr. durum X Tr. monococcum, Tr. polonicum X Tr. durum, Tr. naricum X Tr. Timopheevi and others.

After having cultivated hybrid seeds of the first generation by the solution of colchicin at the concentration of 0.1 percent, A. R. Zhebrak obtained already in 1938 individual normally fertile spikes from first combinations of indicated hybrids. Thus, the fact

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of the appearance of spikes with seeds in highly sterile hybrids indicates amphidiploid, i.e. the process of doubling the number of chromosomes. Due to this process the somatic number of chromosomes of both parents were united in the hybrid. A cytological analysis enabled us to disclose 56 chromosomes in the somatic cell of the first combination and 42 chromosomes of the second combination, i.e. a cytological analysis confirmed the first assumption. Consequently, as the result of experiments of 1938 A. E. Zhebrak obtained two new amphidiploid species of wheat. The first of these species belong to an entirely new group of chromosomes, and the second - to the hexaploid 42-chromosome group.

We did not succeed in obtaining similar species of wheat, although many scientists faced this task. Experimentally created 56-chromosome amphidiploid species of wheat is characterized by the following peculiarities: by high immunity to mildew, dense bushiness, large grain which exceed the grain of the parent species by close threshing etc. According to the character of fragility the new species of wheat occupies an intermediary position between the parent species. According to this characteristic, as the investigation of 1939 and 1940 indicates a slight splitting occurs, and among the second and the third generations of amphidiploid was possible to disclose species both with fragile spike and less fragile spikes. The fertility of the amphidiploid is lower than the fertility of the hard wheat, but higher than the fertility of Triticum Timopheevi.

Possessing greater bushiness in comparison with the bushiness of hard wheat and also immunity to some fungus diseases and to pests, the amphidiploid species which has been called by the author

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Triticum soveticum - the Soviet wheat with a slight negative selection represents an immediate practical interest. The basic significance of the work consists in the fact that due to amphidiploid it was possible to include Tr. Timopheevi into the selection process. With this amphidiploid A. R. Zhebrak made in 1940 crossings of a series of other qualities and species.

The second amphidiploid between hard wheat and monograin (?) ("odnozernianka") wheat has 42 chromosomes and according to the number of chromosomes it does not differ from other species of the 42-chromosome group. According to systematic signs it is closer to hard wheat. This amphidiploid is characterized by high bushiness and unyielding threshing. Besides, in the second generation it was possible to disclose forms with a non fragile spike. This species is of some interest for the further work both as the selection method and the crossing method. This amphidiploid enables us to understand better the process of the origin of the entire group of the 42-chromosome wheat. Until recently two different opinions exist along this problem. The 42-chromosome amphidiploid species indicates that all the other 42-chromosome species could occur by hybridization of 28-chromosome species with 14-chromosome cereals by doubling the number of chromosomes.

The methodology of the effect of colchicin upon the seeds worked out by A. R. Zhebrak in 1938 has been applied to hybrid combinations in 1939, and in 1940 and produced positive results. In the process seven new amphidiploid qualities of wheat have been obtained, and in 1940 their number reached 33. During the 1940 season the amphidiploids of Tr. Timopheevi were obtained. These facts indicate the high effectiveness of the method worked out and applied by A. R. Zhebrak.

For the production of amphidiploid around 106 various crossings were performed in 1939. Among these combinations were obtained hybrids of the seeds of the first generation Triticum Timopheevi with the following species: Tr. vulgare, Tr. durum, Tr. turgidum, Tr. persicum, Tr. orientale, Tr. polonicum.

The greatest number of hybrid combinations was obtained with hard wheat. According to this combination, all species of hard wheat known in USSR are included into the crossing. The author believes that among many amphidiploids it will be possible to produce the most valuable qualities which could be included into production as new species after a slight negative selection.

In 1940 this kind of crossing has been continued and many new hybrids were obtained, but the results of this crossing were not worked out. From crossings of 89 combinations in 1939 were obtained hybrid seeds of 59 various combinations of the hybrids Triticum Timopheevi with hard, soft and other wheat species, were cultivated by colchicine. In 53 combinations amphidiploids are already obtained but a supplementary cytological analysis is required along this line. During 1938, 1939, and 1940 the department obtained amphidiploids along the following hybrid combinations:

1. Triticum durum, v. leucurum Tr. X monococcum
- 1) Triticum durum, v. lecurum, c. "Sary-bugda" X Tr. Timopheevi
- 2) Tr. durum, v. leucurum, c. "Ak-bugda" X Tr. Timopheevi
- 3) Tr. Timopheevi X Tr. durum, v. leucurum, c. "ak-bugda"
- 4) Tr. Timopheevi X Tr. durum, v. melanopus 069
- 5) Tr. durum, v. melanopus 069 X Tr. Timopheevi
- 6) Tr. durum, v. melanopus falcata X Tr. Timopheevi
- 7) Tr. durum, v. melanopus X Tr. Timopheevi
- 8) Tr. Timopheevi X Tr. durum, v. hordeiforme 0189
- 9) Tr. durum, v. hordeiforme 0470 X Tr. Timopheevi
- 10) Tr. Timopheevi X Tr. durum, v. hordeiforme 0432

- 11) Tr. durum, v. hordeiforme 0432 X Tr. Timopheevi
- 12) Tr. durum, v. hordeiforme 027 X Tr. Timopheevi
- 13) Tr. durum, v. hordeiforme 027 X Tr. Timopheevi
- 14) Tr. Timopheevi X Tr. durum, v. hordeiforme 010
- 15) Tr. durum, v. hordeiforme "Arnautka" X Tr. Timopheevi
- 16) Tr. durum, v. erythromelan X Tr. Timopheevi
- 17) Tr. durum, v. apulicum 16240 X Tr. Timopheevi
- 18) Tr. durum, v. borano-leucurum 17142 X Tr. Timopheevi
- 19) Tr. durum, v. leucomelan 16233 X Tr. Timopheevi
- 20) Tr. durum, v. Scherhurdinii 16481 X Tr. Timopheevi

- 1) Tr. persicum, v. stamineum 35029 X Tr. Timopheevi
- 2) Tr. Timopheevi X Tr. persicum, v. rubiginosum 11891

- 1) Tr. orientale, v. insigne 15992 X Tr. Timopheevi

- 1) Tr. polonicum X Tr. Timopheevi
- 2) Tr. polonicum, v. villosum 23562 X Tr. Timopheevi
- 3) Tr. polonicum X Tr. Timopheevi

- 1) Tr. turgidum, v. rubriatum X Tr. Timopheevi
- 2) Tr. turgidum, v. Herrerae X Tr. Timopheevi
- 3) Tr. turgidum, v. Dreischianum X Tr. Timopheevi

- 1) Tr. polonicum X Tr. durum, v. melanopus 069

- 1) Tr. vulgare, v. lutescens "Marquis" X Tr. Timopheevi
- 2) Tr. Timopheevi X Tr. vulgare, v. lutescens "Marquis"
- 3) Tr. Timopheevi X Tr. vulgare, v. alborubrum "Sandomirka"
- 4) Tr. Timopheevi X Tr. vulgare, "Volokolamskaja"
- 5) Tr. Timopheevi X Tr. vulgare, v. erythrosperrum 2411
- 6) Tr. Timopheevi X Tr. vulgare, v. militatum 0553
- 7) Tr. Timopheevi X Tr. vulgare, v. lutescens "Tetcher"

Besides the enumerated amphidiploids there exist others with six various numbers of hard wheat from the collection of the All-Union Institute of Plant Production whose variety has not been determined.

From the obtained amphidiploids four species could be considered as new, five new subspecies, and the rest - new varieties and races. Among these amphidiploid species we have three various chromosome groups: 42-chromosomes, 56-chromosomes and 70-chromosomes. The first of them, 42-chromosomes, existed before and therefore the amphidiploid of hard wheat produced by A. R. Zhebrak enables to disclose a process of the

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origin of all other 42 chromosome species. The last two, 56-chromosomes and 70-chromosomes are produced by A. R. Zhebrak by the experimental method. To the 56-chromosomes group belong the following amphidiploids: Tr. Timopheevi with Tr. durum, Tr. turgidum, Tr. polonicum, Tr. persicum, Tr. orientale. The first amphidiploid obtained by A. R. Zhebrak of hard wheat and Timopheev wheat has been given the name of Triticum soveticum. Consequently, in a short time (2-3 years) A. R. Zhebrak produced a new species of wheat with a series of varieties and races.

The greatest number of amphidiploid species was obtained from the crossing of Tr. Timopheevi with hard wheat. A special attention has been given to the crossing of various varieties and species of hard wheat ~~has been~~ the amphidiploids of hard wheat with Triticum Timopheevi are of immediate practical interest, because according to the grain quality it is close to hard wheat and in its bushiness it exceeds it. In immunity they are close to Tr. Timopheevi.

The limiting circumstance in the introduction of new amphidiploid varieties of wheat into agricultural production could be explained by its low fertility, because amphidiploids are less fertile than hard wheat, but according to this basic characteristic the obtained amphidiploids differ depending on the species taken for crossing. Thus, for instance, amphidiploids Tr. Timopheevi X Tr. durum X gordéform 0189 are closer to hard wheat in their fertility. All the amphidiploids have spikes with average number of grains higher than 3, and the majority of spikes have in their small ears not less than 4 grains. In general the fertility of amphidiploids is lower than the fertility of hard wheat. In agricultural practice the decision how to utilize many amphidiploids of plants (including amphidiploids of wheat) depends upon the degree of fertility.

The department worked also on the improvement of polyploids and amphidiploids in cotton. This topic has been discussed by the candidate Razev, assigned to the chair of Genetics of the Azerbaïdzhani Agricultural Institute, under the supervision of A. R. Zhebrak. As a result of this work 3 amphidiploids were obtained from the hybrids of species of cotton with varied number of chromosomes. This result indicates the fact that the application of colchicine enables us to obtain amphidiploids and polyploids in a large number with various plants.

In all these works it is important that the obtained results are achieved by the effect produced by colchicine. This refutes the opinions of old autogeneticists who considered the seed plasma isolated from external conditions and immune to external influence. This also refutes the naive Lamarque conception concerning the adequate change of genotype under the influence of a specific factor of the environment. The work of the department indicates that colchicine specifically affects the material inherited structure of the cell in increasing the number of chromosomes. This work confirms the dialectical unity of the inner nature of plants with the environment and the interrelated processes with external factors.

The application of colchicine is important by the fact that this is a very effective external factor. The experimenter is able to reconstruct the available species of plants and to produce new ones. By combining hybridization with the effect of colchicine it is possible to create new species in unlimited number which did not exist in nature and which it was hard to obtain before. The recent experimental work by applying the hybridization method and the effect of such

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factors like colchicine indicates that contemporary classical genetics
conquered the methods of evolution and is able not only to explain
the evolutionary process, but even to produce new plant varieties.

July 28, 1951

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K. A. Timiriacheva [The Timiriachev Agricultural
Academy]. Moskva, Sel'khozgiz, 1946, 106 M852 So
390 p.

Translation 196: Plant Protection.

Agri-Sci., 1-51

Translated from the Russian by R. Dembo.

The Department of Selection and Seed Growing of Field Crops (p. 232-237).

The first work on the selection of agricultural plants started in the Timiriachev Academy (then - Moscow Agricultural Institute) in 1903 by the assistant of the Department of General Agriculture and Soil Conservation, D. L. Rudzinskii, with the assistance of the superintendent of the Department, academician V. R. Williams. This work did not belong to the program of the subjects in the department, and their initiation could be explained only by D. L. Rudzinskii's interest in plant selection.

In order to evaluate the historical significance of this undertaking, we should take into consideration that it started at the time when Russia did not have even a single selection institution, when only a few seed farms of this huge country took care of seed varieties, whereby their material was the varieties from abroad. Then there were no courses on selection in any of the agricultural schools, but even the word "selection" and the conception "variety" were entirely strange to agricultural production.

Therefore it would be no exaggeration to say that D. L. Rudzinskii is the pioneer of selection work in Russia, and the Timiriachev Academy is the birth of this work.

In 1903 began the work with potatoes, winter and spring wheat, oats, and somewhat later (in 1905), with beans. In 1903 all the nurseries occupied 240 square "sazhen" (2,154 meters) upon occasional fields. Two small rooms with a total space of 30 square "sazhen" served as a laboratory. The budget fluctuated from 400-1000 rubles. The entire personnel consisted of D. L. Rudzinskii and two workers (one of them - N.I. Khokhlov is working in the Academy until now).

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Rudzinski's group aimed to give the first practical results of selection and thus to start the advertising of selection in Russia. Due to Rudzinski's extraordinary energy and efficiency, he succeeded to give after six years, the Russian selection varieties of potatoes, winter wheat, oats and beans, even in such poor quarters, without the necessary equipment, under very modest work conditions and with a very poor budget. Some of these varieties will remain up to the present time, standardized for wide raions (the Moscow oats A-315 occupies a field of over a million hectares).

In the year 1900 the Saratov Selection Station was opened. After a year, the Department of Agriculture organized the selection station at the Moscow Agricultural Institute with a budget of 3000 rubles. Starting with January 1913, Rudzinski has been appointed the head of the selection station, and S.I. Zhagalov (who was a practitioner in 1909) was appointed as his assistant. The Council of the Institute secured 13.6 'desiatina' of land for the selection station.

In connection with the casual characteristics of the initiation of selectionary work at the Moscow Selection Institute, the work of Rudzinski's group did not have any direct connections with the educational activity of the Institute for six years. Only in 1903 did the situation improve. From this time on, the selection station worked out methods for selection, the study activity and the practical selection of varieties for the zone with non-black soil.

Nevertheless, until 1923, selection was considered as a non required subject; there was no department for it, and the selection station carried out its work only during the summer months with some students and agronomists. A short course on selection was given during 15-16 hours.

In 1923, a department of selection and of Genetics of Agricultural Plants with a required course was initiated. As its first head was appointed Prof. S.I. Zhagalov who was also entrusted with the heading of the selection station of the

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Academy. S. I. Zhegalov published a series of work on selection of rye, wheat, forage grass, the genetics of oats and others. He lay the foundation for the selection of garden plants and starting with 1920 he headed the department of orchard-garden seed production developing the work at the selection orchard-garden field. In 1926 S. I. Zhegalov organized genetical and selectionary work with garden plants at the farm "Gribovo", which has been reorganized into Gribov selection station.

In 1926 S. I. Zhegalov edited a Guide "The Introduction to the Selection of Agricultural plants", which became the basic manual for colleges and universities, and also for everyone who worked in the domain of selection and genetics.

Starting with 1928, after the death of S. I. Zhegalov, the head of the department became A. I. Lisitsyn.

The selection station became a part of Moscow Selection Center in 1932 and ceased to exist as a separate scientific-research institution. After three years, the field experimental station renewed its activity.

From the very beginning of the existence of this station, the selection work, united with the selection department, concentrated under the independent division of the station. Officially, the selection division has been confirmed from 1930, whereby this division was headed by the assistant head of the department V. V. Koshalov. At the present time, the selection work on field plants is carried out in the Academy by the Department of Selection and Seed Production with a close assistance of the selection division of the field station. The course on Genetics has been set off as a separate department.

The coworkers of the station have worked out a series of questions which are basic in the processes of producing and propagating new varieties of field crops. We must mention "The Cytological Analysis of Wheat and Vetch (Vicia sativa)",

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by Nikolaev and Svashnikov, "The Theory of Hybridization of strange varieties", by Zhegalov, Karpechenko, Svashnikov, "The Study of Mutation Changes", by Zhegalov, Ivanov, "The Method of Selection of Grain and Vegetables", by Ruszinskii, Zhegalov, Timofeev, etc., "The Methods of flax selection", by Matveev, "The Physiological and Biochemical Causes for the Frost Immunity of Winter Wheat", by Govorov, "Problems of the biology of clover", by Lorkh, Lisitsyn, Selavri, Lisitsyna, Fedorchuk, Samsonov, as the most important works published during the indicated period.

At the present time, at the department of Selection of Field Crops of the Academy there is still carried out pedagogical and exploring work. For the preparation of specialists in the domain of selection and seed production there has been organized at the Academy a special division of selection and of seed production which is included into the field production department. At this division, the profile of the student-selector is determined by a series of courses, namely: Genetics, General Selection, Individual Selection, Production of Varieties, Seed Production and, finally, Agricultural Ecology. The practical work is carried out by the students during the summer between 3 and 4 courses. A six month practice is carried out between 4 and 5 courses. The productive practice is carried out upon 13 best selection stations of USSR.

Starting with 1929, the Department had prepared 300 specialists who work at the seed production system, upon selection stations and in Institutes.

The course measures occupy an important place in the preparation of cadres. Fifteen thousand approbators and about six hundred agronomists-seed producers were prepared only for the last five years. Not less than one thousand persons went through the qualification courses.

The experiment of the Department's work is utilized widely in other colleges and universities of our country. During recent years the methodical approach of

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teaching and the pedagogical process itself are closely related with the scientific-research and production work which are carried out by the Department's workers.

Students who yearly carry out work on 10-13 topics are of great assistance to the Department.

During the last three Five-Year Plans individual instructors obtained valuable results in research work which were widely applied in the National Economy of the Soviet Union.

The Academic P. I. Lisitsyn is the first organizer of the Soviet Socialist Seed Production for which contribution he was given the title of the honorary worker of Science and Technique. The manual written by him became the foundation for guiding courses on seed production in all agricultural educational institutions of USSR. He also worked out the methods in selection of clover. The works of Lisitsyn on Biology of clover, on the study of the basic material (wild clover) enjoys world fame. The clover variety which has been produced by Lisitsyn goes through state testing. The varieties of Middle Russian clover, rye (Lisitsyn) and oats Shatilovsk 56 produced by Lisitsyn occupy on the fields of the collective farms three millions six hundred thousand hectares.

P. I. Lisitsyn carries out at the present time a great part of his research work at Alexandrovsk selection station (Ivanovsk Oblast') where he works out the following problems;

1. Nitrogen dynamics in the root system of clover. The results of this work were used by Lisitsyn as the material for a report in which he discussed the necessity of surveying the existing measures in utilizing the clover turf (sod).
2. The change in the nitrogen content in the clover part which is above the ground. According to obtained data, the food value of clover might be determined not by the percentage of the leaves, as it is practiced at the present time,

but by a direct chemical analysis. The correlation between the percentage of leaves and of raw protein does not exceed 0.3. This fact changes the all-accepted method of clover selection upon one of the most important economic signs.

3. The effect and the duration of heterosis with rye with free and compulsory crossing of standard varieties of rye on non-black soil in pairs, in threes and fours.

4. The process of segmentation of hybrids of standard rye with local samples of rye of the Far North.

5. The production of non-lodging Lisitsyn's rye.

6. The Agrotechnics in the seed production of winter vetch, (Vicia Sativa).

At the Aleksandrovsk station P. I. Lisitsyn carries out the propagation for the production experiments of varieties of wild clover which are most interesting in regard to frost resistance, longevity and ability to resist the spring floods.

Candidate V. E. Khokhlov worked out the methods of selecting flax, carried out an extensive organizational work on the system of variety control, began the organization of seed production of Southern and Middle Russian hemp. The varieties which he produced: flax-"dolgunets" D83 (growing upon 120 thousand hectares), seed flax K48 and K39 (occupy a field of 300 thousand hectares), buckwheat "Bogatyr'" (occupy 93 thousand hectares), are widely circulating in production. Rye, Moscow "Viatka" is also introduced in production. Two sorts of winter wheat which are awnless and of 15-20 percent ^{higher} yielding capacity than the standard variety 2411, and one variety of buckwheat are at the stage of preliminary propagation.

Candidate A. P. Gorin worked out a series of problems in the biology of spring wheat under the conditions of non-black soil belt. Two perspective varieties of spring wheat are contemplated.

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Candidate Malygin handed over four varieties of oats to the state for variety testing.

Candidate Kharchenko worked out methods of selecting hops which have been accepted at a series of stations. Two prospective varieties of vetch which are now under final testing were produced.

The academic Lisitsyn's clover group works in the department. This group carries out its research with agreement means (The Institute of Forage and the Lenin Academy of Agricultural Science). The chief scientific worker of this group, V. P. Fedorchuk, carried out a tremendous work on the embryology of clover which enables us to determine the causes of instability of yield in seeds of this plant and the beginning of the selection of clover upon the seed yield by means of selection of plants with a high percentage of bigrain legumes.

In this group Veprikov (P.N.) carried out work in respect to the yield of seeds of red clover, depending upon its production and conditions of spraying. These works were published in 1936.

The chief scientific assistant M. I. Lisitsyn worked out the method of artificial infestation of clover by canker and the selection of clover for the immunity to canker. At the present time she is studying fusarium.

The chief scientific assistant, S. K. Selavri, is studying the causes for the destruction of clover from unfavorable winter conditions. The obtained results indicate that, although agrotechnical measures do increase the frost resistance of clover, yet they are unable to guarantee the preservation of clover sowings under unfavorable winter conditions. It has been determined at the same time that some varieties of wild clover winter without any losses during the severest winters.

Finally, the scientific worker, G. Z. Nemkin, produced among the representatives of wild clover some varieties which are resistant against spring floods,

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i.e., which are suitable for meadows, submerged under water.

Before 1915 the scientific works of the selection station used to be published in "The Works of Selection Stations" which were edited annually. Seven issues appeared altogether. Between 1915 and 1929 works used to be published in "The News of Moscow Agricultural Institute", then in "The News of Timiriachev Agricultural Academy".

After 1929, eighteen scientific works of the Department's personnel were published in the magazine "Selection and Seed Production".

Besides, the following books were published: One book (on clover), two textbooks on selection and seed production for colleges and universities, one text-book on selection for technicums, one textbook on variety studies and one manual for the practical work of students.

Under the editorship of P. I. Lisitsyn the Agricultural State Publishers published a guide for agronomists-seed producers and for brigadiers-seed producers and a handbook on individual selection.

A/P

September 7, 1951.

End of Chapter.

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K. A. Timiriazeva (The Timiriazev Agricultural
Academy). Moskva, 1946, 390 p. 106 1852Se

Transl. 196, Cont.

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Translated in part by Rosa G. Dembo

The Department of Agricultural Chemistry (p. 174-183)

The independent Department of Agricultural Chemistry at the Timiriazev Agricultural Academy exists somewhat over ten years. Nevertheless, the instruction of Agronomical Chemistry as well as the development of research in the field of agricultural chemistry, has a longer history and began from the very first years of the Academy's existence.

At the Petrovsk Academy between 1865 and 1890 in the Department of Organic and Agronomical Chemistry was offered a course of Agricultural Chemistry which was given by Professors of Chemistry, first P. A. Il'enkov, and then G. G. Gustavson. Prof. P. A. Il'enkov was then first translator of the famous book "Chemistry in its application to Agriculture and Physiology", by Liebig into Russian, and G. G. Gustavson was the author of "Twenty Lectures on Agronomical Chemistry." In his course, G. G. Gustavson discussed the problems of the circular motion of substances in agriculture, soil chemistry and fertilizing chemistry; he organized well the practical work along the agricultural analysis. Nevertheless, this Department, not being agronomical, did not carry out any experiments with fertilizers (these experiments were not included into the program of experiments at the Department of General Agriculture).

The course of Agronomical Chemistry offered by G. G. Gustavson until 1890 has been eliminated from the teaching schedule, when, instead of Petrovsk Academy, the Moscow Agricultural Institute has been organized. The reason for eliminating Agricultural Chemistry from the schedule was, that parts of this course were included into allied courses (Botany, Soil Science Agriculture.) The same reason was given for the elimination of a course of Plant Physiology, offered by K. A. Timiriazev.

The absurdity of eliminating Agronomical Chemistry from the curriculum of Higher Agricultural Institution is now obvious. But it was not easy to prove it at that time.

K. A. Timiriasev, who has been removed from his office at the Academy, with his usual determination advocated the instruction of Plant Physiology and of Agricultural Chemistry. In his article "Plant Physiology, as the Basis for Rational Agriculture", he wrote:

"How could be explained the scientific progress during this last century which was reflected upon agriculture, which transformed its entire characteristics, which transformed it from incoherent collection of recipes and from a blind imitation of successful examples into a coherent, intelligent activity? Of course, by the emergence of two new branches: Agronomical Chemistry and Plant Physiology." And further: "Agriculture became what it is only due to Agronomical Chemistry and Plant Physiology: this is obvious a priori and is proved by the entire history. And is it not strange, that in our country, from the time when we started to speak about the progress in scientific agriculture, these two scientific foundations disappeared as independent subjects from our Higher Agricultural Institutions? The future Historian of the development of scientific agriculture in our country will, certainly, have difficulty in explaining this anomaly."

This "anomaly" continued, nevertheless, to exist and for more than thirty years the course of Agricultural Chemistry was not included in the Academy's curriculum and there was no independent department.

Nevertheless, despite the elimination of Agricultural Chemistry from the curriculum, the instruction of the same and the research work in this branch of science were highly considered at the Academy. It is possible to say without any exaggeration that during the last half a century the Academy

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was the basic place of the preparation of highly qualified scientific agricultural chemical cadres and was the center of the development of agricultural chemical science in our country. The academic D. N. Prianishnikov who could be considered the founder of Soviet Agricultural Chemistry played the most important role in organizing this course.

A student of K. A. Timiriachev, D. A. Prianishnikov, from the very first steps of his activity at the Academy, carried out a persistent, urgent struggle for the rights of Agricultural Chemistry in the curriculum of Agricultural Institutions and also organized the instructorship and wide agricultural chemical scientific-research work. In the matter of further development of individual branches in the agricultural chemical preparation at the Academy, its supervisor, I. A. Dem'ianov, played an important role.

D. N. Prianishnikov who headed the Department of Individual Agriculture started from 1895 the course "Study on Fertilization." In order to obtain the right for offering that course (in the Department of Individual Agriculture), there was some kind of an exchange by the parts of the course with the Department of General Agriculture, and namely, V. R. Williams took upon himself the instruction of Meadow Production, and D. N. Prianishnikov - the instruction on F^rertilization.

Since the study on fertilization was based, according to D. N. Prianishnikov, upon plant physiology and soil chemistry (chapters on absorptive powers, etc.), hence the course was given into the direction of agricultural chemistry (and not only in the direction of fertilization). In the same year, in the Department of Individual Agriculture was organized the laboratory research in which exploration has been carried out on the correlation between the soil and fertilization and on chemistry of plants (the transformation of substances during the growth). Simultaneously, D. N. Prianishnikov succeeded in obtaining

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a nursery (vegetation house) from the Department of Botany. This nursery which has been organized by Timiriachev seemed to be useless for the Department of Botany after Timiriachev's resignation. Later on, Timiriachev donated another nursery which he built for the Nizhegorod exhibit. Timiriachev often expressed his admiration for the experiments which were carried out in these nurseries by Priianishnikov and by his students.

Thus, starting with 1895, definite divisions of agricultural chemistry were included in the Department of Agronomy. Here was also organized the basis for research work on plant chemistry, soil chemistry and fertilization. Priianishnikov attracted a great number of students to this work which was of great significance in the life of the department. The students' work on vegetative experiments became the new link in instructing Agricultural Chemistry.

It is necessary to observe that before the foundation of the Department of Agricultural Chemistry, the students had practical work in agricultural analysis in the Department of Organical Chemistry. Under the supervision of Dem'ianov the instruction of this subject was well organized. Thus for a series of years the instruction of agricultural chemistry at the Academy has been gradually realized, due to the initiative of Priianishnikov and Dem'ianov, at the time, when even the word "Agronomical Chemistry" was not recognized as an official terminology.

Priianishnikov, being the assistant director of instruction, introduced in 1908 into the curricula of Agricultural institutions of higher learning diploma dissertations; this requirement forced the students for experimental scientific work; simultaneously, there were carried out measures in eliminating many courses by introducing sections; the first sections were agricultural

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chemistry and soil study. The number of dissertations in agricultural chemistry was quite high during that period and they became another link in the preparation of agricultural chemists.

Finally, 1910, Prianishnikov started a course on the chemistry of plants, at the beginning voluntary (at the request of students' circle), and then the course has been added to the curriculum.

Tremendous efficiency and tireless energy were conducive for Prianishnikov, for over thirty years, in combining the instruction of Individual Agriculture with the course "Study on Fertilization" at the Academy, as well as the lectures on the course of Agronomical Chemistry at the University (and one time - at the Higher Institute for Women), and at the same time to develop research work in agricultural chemistry.

The basic significance in instructing Agricultural Chemistry and in preparation of agricultural cadres was the organizing of the section of Agricultural Chemistry and Soil Study at the Agronomical College which later became a division, and then it became the College of Agricultural Chemistry and of Soil Study. It is quite interesting to observe that the section was organized earlier (1908), which fact made it possible to organize a separate Department of Agricultural Chemistry (1928).

Only under the Soviet Regime, when numerous new institutions of higher learning sprang up, some of these institutions introduced separate Departments of Agricultural Chemistry (Krasnodar, later Perm'), although without being approved by the statute. The Main Committee on professional education included in 1920 agricultural chemistry into the curriculum of agronomical schools, yet that curriculum has not been realized. But, according to the development of chemical industry, with the realization of great prospects in the wide chemization of national agriculture of USSR the agricultural institutions of higher

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learning accepted in 1928, as a rule, the existence of the Department of Agricultural Chemistry. An independent Department of Agricultural Chemistry has been organized at the Academy in 1927, in connection with the impossibility of uniting in one person the supervision of the courses of Individual Agriculture and Agricultural Chemistry after the departments were enlarged.

Starting with 1930, in connection with the increase of specialization, besides the general course in Agricultural Chemistry, the department organized the following divisions: the methods of agricultural chemical research, physiological bases for applying fertilization, fertilization systems in the farms of various specialization. At that time was worked out a wide program in agricultural chemistry which was offered in other institutions of higher learning which have special Colleges of Agricultural Chemistry and Soil Study.

In 1931-1932 the Department acquired the means for increasing the volume of laboratory-practical studies in agricultural chemistry and receives equipments for new laboratory premises.

In 1940 the Department served four colleges (Agricultural Chemistry and Soil Conservation, Field Production, Fruit-Vegetable Production and Economics), the Division of Absentee Instruction, Division of Agricultural Education, and carried out tremendous work in preparing and improving the qualification of workers of Socialist Agriculture.

At the Department were offered in 1940 the following courses : 1) General Course of Agricultural Chemistry (Academic Prianshnikov) 2) Methods in Agricultural Chemical research (Prof. B. A. Golubev), 3) biochemical bases in applying fertilizers (Cand. A. G. Shestakov) and 4) systems in fertilization (Cand. V. M. Klechkovskii).

Besides, separate courses in lectures on Agronomy were held at the Colleges of Field Production and Fruit-Vegetable Production (Card. O. K. Kedrov-Zikhman) at the College of Economics.

The workers at the College of Agricultural Chemistry wrote a series of textbooks and manuals which are used by students of Agricultural Chemistry, not only at the Academy, but at other education institutions as well.

The scientific-research work of the Department of Agricultural Chemistry has a great history starting with the first years of Priianishnikov's work at the Academy.

Scientific works of Priianishnikov and his laboratory made him world famous and placed Soviet Agricultural Chemistry at one of the first places in world science.

Starting with 1896, Priianishnikov's Department became simultaneously the Agricultural chemical experimental station. During the first period (1896-1908) the scientific work has been organized only by the means and strength of the Department, without any additional personnel, but by drawing a considerable number of students of senior standing to this work. The organization of research work of the Department which has been realized at the beginning by Priianishnikov in institutions of higher learning consisted in drawing all students of senior standing (then about 50 students) to vegetative experiments, but not in the form of a simple acquaintance with the methods, but by means of permitting every student of carrying out his own experiment, even if small, in such a manner that it would become a certain link in the entire outline of the Department's work for the current year.

But, since it is impossible to draw definite conclusions from experiments taken separately, each experiment was carried out parallel with other students.

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At the outset it had been assumed that, if only 50 percent of the experiments corresponded in accuracy, then it was possible to achieve good results, due to a great number of experiments. But reality excelled these expectations, and the first period of the existence of the Department-Station was so rich with results, that, so far as vegetative experiments is concerned, it is hard to require anymore.

As a result of such research, it was possible during the first years to bring clarity into the phosphore problem which had been so complicated before, due to the disintegration in the study of the role of the soil and that of the plant and of the phosphorite qualities. Further, it has been given attention to fertilizers, whereby new data were obtained not only for ammonium sulfate, but for ammonium nitrate as well, which data changed entirely the conceptions on the physiological characteristic of this compound. During this very period the first experiments were carried out with the mixture of various doses of lime upon various ground which disclosed the necessity of a thorough approach to the problem of controlling soil acidity. To that period also belong the experiments with iron phosphate and lime soil, experiments with potassium minerals which manifested assimilability of potassium in nepheline, and also the first experiments with nutrition mixtures, which caused the origin of a new variation ("Prianishnikov's mixture"), etc. On a series of problems which we are unable to discuss here, we obtained new results which are not only of local significance, but significant as well, in connection with Prianishnikov's famous laboratories.

The second period of the Department's existence which began in 1908 is characterized by the fact that the Department began to obtain means for the organization of research work and for the invitation of a special personnel,

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so that an experimental station sprang up within the Department, although without a special statute and definite personnel.

If the first work of the Department pertained primarily to the study of such sources of fertilization which are accessible to Agriculture without the assistance of chemical industry (phosphorites, lime, ashes, potassium minerals, components of dung, etc.), then, during the second period an important role was played by the products of chemical reproduction of phosphates (superphosphate simple and double, dicalcium phosphate dihydrate), whose methods, in applying to our raw materials, underwent a thorough study for the first time.

Here was proven for the first time the erroneous opinion about the ineffectiveness of all our phosphorates for its reproduction into simple superphosphate; further, were discovered measures for extraction of phosphoric acids, the conditions for precipitating conditions for infusion prepared of various phosphate raw material etc. were examined.

The first works of the Technological Division of the Scientific Institute on fertilization on the production of phosphorates were based upon these data.

The scope of problems worked out by the Department was very wide. Thus, besides phosphates, the sources for nitrogen were studied (the nutrition by ammonium compounds, cyanogen; a series of work was dedicated to the problem of utilizing turf nitrogen), further - was studied the problem of nutrition with iron, of the significance of calcium for plants, of root secretions, of the introduction of anions and cations, of nutritional mixtures in general, the methods of sterile plants were studied in applying them to higher plants etc.

Besides the work on plant nutrition and fertilizers' study, a series of work has been carried out on soil chemistry. Thus, the measures in determining

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absorbed substances (potassium, ammonium and calcium) by means of eliminating neutral compounds were studied. Measures were applied based upon research carried out and developed by K. K. Gedroits and by other explorers.

Factually, the erection of an experimental station was not followed at the beginning by a formal action or by the supplement to the statute of the Agricultural Academy, partly because the organization of agricultural chemical work at the Department of Individual Agriculture was not easily organized; therefore, aiming towards some kind of solidarity with the problems of the Department the name was given: "Station on problems of plant nutrition." The agricultural chemical station has been formally legalized and obtained status later, namely, in 1920.

At this time, a new period began in the life of agricultural chemical experimental station during which time the work has been expanded and many important scientific works were published. For awhile the station at the Department became factually the chief center of work on the problem of fertilization (until the Scientific Institute on fertilization, whose agricultural chemical division was organized in 1919 based upon the Department and its stations and which was entirely based upon its cadres, acquired its own building, and nurseries were erected upon the "Dolgoprudnyi" experimental field).

Means for the development of its work during this period were acquired by the station as subsidies from a series of farm organizations and of research institutes of the Higher Soviet of National Economy.

The most important problems on plant nutrition and soil chemistry were at the centre of attention of the station's work. These problems were connected with the branches of chemical production which should serve agriculture. Thus in connection with the development of production of synthetic ammonia, an

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extensive work has been carried out on the problem of utilizing ammonium nitrate for plants (the works of D. N. Priianishnikov and V. S. Ivanova, I. G. Mikusar', etc.). In connection with the discovery of Solikamsk deposits, new data were obtained for the physiological characteristic of potassium compounds (works of Priianishnikov, V. V. Butkevich and others). In connection with the problems of liming, the forms of soil acidity were studied (the works of Druzhinin, Golubev, Askinazi, Iarusov and others), and also causes of uneven relation between plants to the same degrees of acidity upon various soils (works of B. A. Golubev, and others). New methods were introduced in the study of nutrition mixtures for plants (especially for technical). These measures ensured more the immunity of the solution reaction (works by M. K. Domontovich, T. T. Demidenko and others). Further, they paid their attention to the role of microelements etc. Thus, in the foreground always stood the basic problem of summing up physiological and chemical bases by the fertilization method.

The chief results of the Department's scientific work are reflected in sixteen volumes of reports and in numerous articles of D. N. Priianishnikov and of his assistants in a series of magazines, here and abroad.

But besides the immediate working out of a series of scientific problems, the station was the school of research, influencing favorably the Department's activity. Thus, if about 30 students close to Priianishnikov now are heading departments of Agricultural Chemistry, Plant Physiology, and Agriculture at Agricultural Institutions of Higher Learning of USSR, then their education of course, was promoted by research work which developed widely in the Department due to the establishment of the stations.

At the station the following professors began their scientific activity:

R. R. Shreder, V. V. Winer, N. K. Nedokuchaev, V. S. Butkevich, K. K. Maliushitskii,

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A. G. Doiarenko, I. S. Shulov, A. N. Lebediantsev, I. V. Iakushkin, A. A. Kaluzhskii, A. E. Sokolovskii, G. G. Petrov, V. P. Kochetkov, A. D. Murinov, V. I. Sazanov, F. T. Periturin, F. V. Chirikov, E. A. Zhemchuzhnikov, E. V. Bobko, A. I. Smirnov, A. A. Stol'gane, A. F. Tiulin, D. V. Druzhinin, A. Z. Lambin etc. Besides of institutions of higher learning here originated cadres for research institutions which were initiated later. Thus, with the erection of the Scientific Institute on fertilization, its agronomical division offered the instructorship to those who studied at the department/^{and} at the station. When the Central Institute for Sugar Production originated, then for the formation of its agricultural chemical division ten professors were ^{it} elected among the workers of the station and among the candidates of the department. Besides Moscow, a series of institutions in other cities have personnel which studied at the same Institute. And, finally, when the All-Union Institute for Fertilization, Agricultural Technics, and Soil Study has been established in 1931, the agricultural chemical station was included in its entirety in the institute, as the starting cell for its erection.

Among the Department's and Station's workers who worked here during various periods, and now are carrying out the leading scientific work in other scientific research institutions, we may mention the following: E. V. Bobko (Doctor of Agricultural Science, supervisor of the laboratory on microb fertilization and assistant of the Head of the laboratory of mineral fertilizers of the All-Union Institute of Fertilization); A. F. Tiulin (Doctor of Agricultural Science, Head of the laboratory of soil colloids of the same institute), S. S. Iarusov (Doctor of Agricultural Science, Assistant Head of the lime laboratory of the same institute), Doctor of Agricultural Science, Prof. F. V. Chirikov, Prof. I. G. Dikumar, Prof. T. T. Demidenko (Head of the Labor-

atory of Physiology of the All-Union Institute of Oil Plants in Krasnodar'), D. L. Askinazi, Z. A. Logvinova, V. V. Butkevich, Z. I. Zhurbitskii (Head of the Agricultural Chemical Division of the All-Union Institute of vegetable production).

In 1931, the All-Union Institute on Fertilization, Agricultural Technic and Agricultural Soil Production acquired not only the personnel, equipment, and the building of the agricultural chemical experimental station of the Academy, but the entire staff of candidates. It is clear that this could not be reflected on the scope of the scientific work of the department. Nevertheless, soon afterwards the scientific research work of the department restored and gradually reached its large scope. Starting with 1933 candidates were admitted to the department. At the present time the number of candidates at the department reached ten; the entire instructional personnel of the department participates in scientific research work.

During recent years at the department was intensively studied plant nutrition, according to the growth periods, in connection with biological chemical processes in the influence of fertilization upon the quality of the crops. The results of the work which have been carried out at the department in this direction (I. G. Bikusar, I. V. Culiakin, A. F. Kalinkovich, A. V. Vladimirov, I. I. Gumar, and others) became the foundation for a series of recommendations accepted at the present time in applying fertilizers (basic, regular, and feeding) for individual plants (sugar beets, kok-sagyz, etc.).

Important results were obtained in the study of new fertilizers, which were not applied at first: termophosphate, blast-furnace slag, glaserite and others, (work of A. G. Srestakov, V. K. Koechkovskii, and A. V. Vladimorov), the significance of sodium in the composition of fertilization for

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a series of plants - sugar and foddering beet and others - has been explained (work of D. T. Druzhinin, A. G. Shestakov).

In the domain of studying the problems of chemical amelioration of soil, the significance of mobile aluminum in the soil, which is one of the basic conditions for the decrease in crops of individual plants upon acidic soil, has been proved (work by B. A. Golubev); the application of lime fertilizers and of lime tuffs which contain magnesium has been widely examined (O. K. Kedrov-Zikhman and O. E. Kedrova-Zikhman); a series of new facts concerning the conditions of effective application of fertilization by boron and copper (work of O. K. and O. E. Kedrov-Zikhman, A. G. Shestakov, M. D. Bakhulin). New methods of utilizing peat and peat soil in the raions of peat production are introduced into production, for instance, the application of peat slag and other fertilizers (work of M. D. Bakhulin).

Of especially great significance is the scientific-social activity of the head of the department, academic-prize winner, D. N. Prianishnikov.

Along with A. E. Bakh, Prianishnikov was one of the initiators of the establishment of a committee on chemization of national economy of USSR and participated intensively in its work. With the assistance of the Committee on chemization, in agricultural institutions of higher learning of USSR, starting with 1928 were established independent departments of agricultural chemistry.

In his work D. N. Prianishnikov devotes considerable attention to state planning for production and for the application of fertilizers. In 1921 he delivers a report at the State Plan Commission on the topic: "The immediate problems in the field of production of mineral fertilizers" in which he emphasized the need of agriculture of USSR in phosphates.

From 1922 until 1925, as a member of the State Planning Commission, D. N. Prianiashnikov participated actively in determining the prospects in production and in the application of fertilizers in USSR.

Without limiting himself to the work in State Planning Commission, he delivers a series of reports and publishes a series of articles which attracted the attention of all the workers of industry, agriculture and the entire Soviet social interest to the problems of fertilizer production and its significance in the increase of crops. In some works Prianiashnikov advocates the military strength of the Soviet Union, indicating a close relationship between the needs for defense and the problems of chemization of agriculture.

The most active part is played by Prianiashnikov in the working out of Five-Year plans in the development of the national economy of USSR. He promoted the idea of planning all fertilization resources of the country, encourages the unification of the measures in the system of agriculture and of chemical industry aiming to ensure the necessary growth of crops.

Pointing out constantly the necessity of the highest development of chemical industry and of maximal increase of production of mineral fertilizers, Prianiashnikov simultaneously points out to the workers of socialist agriculture, the problem of adding nitrogen at the cost of increasing the sowing of clover, alfalfa and other legumes, at the cost of a better conservation of dung, at the cost of better utilization of peat and of other kinds of local fertilizers.

Already in 1925, in his speech "Mal'tus and Russia", Prianiashnikov, opposing Mal'tus theory, proved that in our country there are great potential possibilities for the increase of crops indicating, as primary measures, the shift to crop rotations with clover and plowing plants and the application

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of fertilizers. He insisted upon the fact, that at the time, when the population in our country will double up, the agricultural production could be doubled 6-7 times, and with the extent of plowing land, even 12-14 times.

The Stakhanovites of socialist agriculture indicated in reality the limitless possibilities in the increase of crops. The great attention of Stakhanovites in the application of fertilizers is the best proof how great is the significance of fertilizers in the increase of crops.

Prianishnikov's work in the field of plant nutrition had not ⁿ only an applied, agronomical significance, but solved basic problems in general physiological sense as well.

In 1929 Prianishnikov was elected active member of The Academy of Sciences of USSR. From 1935 he is active member of the Lenin All-Union Academy of Agricultural Chemistry and Chemization of Agriculture of the Academy of Agricultural Science which was established with his initiative.

We must also mention Prianishnikov's wide activity in representing Soviet Agronomical Science at various scientific conventions and congresses abroad and at international scientific organizations. His scientific reports and public addresses at international conventions have been always a striking illustration of the progress of agronomical science in our country.

In 1930, at the International Congress of soil surveyors, Prianishnikov has been elected President of the Fourth Commission (soil fecundity) of the International Association of Soil Surveyors.

As the greatest scientist with a world name, Prianishnikov has been elected honorary member of a series of scientific organizations abroad.

Prianishnikov's contribution to socialist motherland has been often mentioned by Soviet social organizations and their leading organs: in 1926 he

received the Lenin reward for his scientific work, and in 1932 - the reward on the chemization of national economy of USSR.

In 1936 Priianishnikov has been rewarded by the Order of the Labor Red Banner and in 1940, in connection with the seventy-fifth anniversary of Timiriachev Agricultural Academy - with the Order of Lenin. Academic Priianishnikov received for his scientific work "Agricultural chemistry" which is a textbook for agricultural institutions of higher learning the Stalin prize of First degree.

The basic problem of the Department's personnel and of its Head is the preparation of highly qualified cadres in carrying out the tasks of Socialist Agriculture which, in the decisions of XVIII Congress of All-Union Communist Party (b), were reflected in the following point: "To introduce in collective and state farms a correct system of organic and mineral fertilizers paying special attention to the rational utilization of dung and of other local fertilizers, to eliminate losses of mineral fertilizers. To introduce widely the liming of podsol soil and the gypsing of saliferous soil."

The scientific basis of measures on the realization of this task and the preparation of cadres for the carrying out of these measures represent the basic problem of the Department's personnel, as well as of all Soviet agricultural chemists.

End of Article

L.A. B.
9-11-51

Sel'skokhoziaistennaiia Akademia imeni
K. A. Timiriazeva, The Timiriazova Agri-
cultural Academy, 390 p. Moskva, Sel'
khozgiz, 1946 106 M85256

Transl. 196: Institutions

Translated by R. G. Dembo

Academic Williams' Seed-Control Station
(R252-254)

Seed-control production originated in Russia even earlier than
Fr. Hobbe first station was founded (in 1869).

In 1864 at the Riga Politechnic Institute the work on seed analysis
was organized for the first time. Officially the first station was
founded in Russia in 1877 at the Chief Botanical Garden. Starting with
1881 A. A. Fadeev organized the seed control in the Department of Agri-
culture of the Peter Academy.

Later, the entire supervision on seed analyses was entrusted to
V. R. Williams who then was the assistant of Prof. A. A. Fadeev. On
June 11, 1896, V. R. Williams and N. IA. Dem'ianov applied to the Depart-
ment of Agriculture for the foundation and organization of a station for
the research of soil, seeds and fertilizers. The Department of Agriculture
permitted to found a station "which had to carry out analyses of seeds,
soil and fertilizers and of similar work, as experiments, according to
private orders..."

During this period of its activity, the station serves mainly the
Agronomical Division of the Moscow Gubernia District Council and some more
remote Councils from where about 200-300 samples of seed material used to
arrive. One part of the samples passed some control.

During this period started the basic collection of weed seeds, which
is at the present time at the seed-control station where 1982 seed varieties
according to 109 families are registered in the catalogue. This collection
includes almost all species of weed seeds of the entire Soviet Union and

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partly obstructor-seeds which were imported with seed material from abroad.

Later, from the station of soil, seed and fertilizer research, a seed control station has been separated which carried out the seed analyses up to 1932, acting simultaneously as an arbitr and as consultant.

From 1916 until 1923 the control station participates in the preparation of personnel of agricultural workers at special institutions.

In March of 1931, in connection with the reorganization of the Academy, the seed-control station was transferred to the Department of General Agriculture, and in August of the same year became a part of Moscow Oblast' Station which was reorganized into Moscow selection centre.

The transfer of the seed-control station factually excluded from the program of Agricultural Institutions of Higher Learning an entire division "Seeds", which, undoubtedly, reflected negatively upon the preparation of personnel of specialists of Agriculture-agronomists of higher qualification. Thus, from 1931 the Academy lost a station, and its students were unable not only to pass a normal course of seed production and of seed control, but to become acquainted with a well-equipped station as well. On the other hand, the absence of such a station deprived the Academy of a scientific-research base for the course of plant production.

In November, 1934, the station was again transferred to the Academy and became a part of the Department of Plant Production.

From 1934 a special division "Seed Science and Seed Control", which course is required from all students who studied plant production, has been inaugurated. Besides, the course on seed-production has been offered at the majority of courses in improving the qualification and the preparation of the agronomy personnel which are organized at the Academy. In

1938, 1939 and 1940 the control station took direct part in All-Union courses of increasing qualifications of the directors' and inspectors' personnel of seed-control network of the Union. For this purpose the station worked out a series of equipment and of manuals. V. M. Dobrokhotoy wrote a handbook on seed production.

From 1934 the station began research work.

The basic problem of the station's research sums up to the working out of complex mechanical and biological measures which influence the improvement of seed characteristics aiming to increase crop yield.

To the basic works which have been accomplished at the station from 1934 which have been published and utilized in production we must add the following:

- 1) the study of morphological and physical characteristics of standard varieties of cereals in connection with various regions of origin;

- 2) the study of seed qualities of clover of various regions of origin;

- 3) qualitative evaluation of powders for magnetic machine of Soviet and foreign production;

- 4) testing of cotton seeds (working out methods of seed analysis of cotton);

- 5) testing the maturity of raw-cotton and of cotton seeds;

- 6) the working out of the method of delinting cotton seeds with hydrogen chloride and the study of the influence of delinting seed qualities of cotton seeds;

- 7) the testing of the method of seed sprouting with dinitrobenzole (A. A. Gurevich' method) on grains and the working out of a method for determining cotton seed sprouting;

8) the testing of seed cleaning at the Khomutov seed-cleaning plant;

9) agrotechnical evaluation of seed cleaning machines;

10) testing of seed-cleaning machines (work at the Departments of Plant Production, Mechanization and Control Seed Station).

11) the study of the size of plant seeds in connection with the working out of sieve standard.

An important place in the work of the station occupy the productive analyses of seed material. The station serves the field station of the Academy, a series of scientific-research organizations. The station carried out the evaluation of seed material which arrived at the All-Union Agricultural Exhibit.

The amount of varieties which passed through the station from 1935 up to 1940 inclusive, reached 7781; 19755 analyses were carried out. Aiming towards rationalization and precision in seed research, the personnel of the station worked out a series of devices.

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Tumanov, I.I., Enikeev, S.G., and Lizandr, A.A.
Primenenie rostovykh veshchestv dlia povysheni-
ya urozhainosti kul'turnykh rastenii [Utiliza-
tion of growth substances in increasing the
yields of cultivated plants]. Sovet. Agron.
4(7): 25-32. July 1946, 20 So84

Transl. 198: Growth
Substances.

Translated from the Russian by S. W. Monson.

been
Sixty five years have already spent on the study of growth substances. Of these, over fifty were spent on purely theoretical research. The possibility of applying physiologically active substances in practice was established only after 1934, following the discovery of the Dutch chemist Kogl that indoleacetic acid represents one of the growth regulators (heteromaxin). This acid the chemists produced in their laboratories synthetically.

Thus physiologists obtained a preparation which reacted upon plants. Subsequent studies of compounds resembling indoleacetic acid disclosed that many other chemicals were growth substances.

Over one hundred of these compounds are known at present. They are the derivatives of indole, naphthaline, naphthole, phenoxy compounds, and benzoic acid. It became possible to select from among different growth substances those most active, which penetrate rapidly into plants, and are inexpensive and easily applied. In practice the following growth substances received the widest application: naphthyl acetate, indolebutyric, indoleacetic, naphthoxyacetic, dichlorophenoxyacetic, chlorophenoxy acetic acids and their derivatives. Physiologists and agronomists have studied the application of growth substances in plant industry for about ten years. The above preparations were used with success for various purposes: rooting grafts, obtaining seedless fruits, preventing fruit drop from apple trees, delaying growth of potato tubers in storage, weed destruction, and for solving many other practical problems. There were, nevertheless, failures. Direct application of growth substances to increase yields proved unsuccessful. Such attempts were repeatedly made.

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Tumanov, I.I.

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Attempts were also made to increase yields of cultivated plants by treating seeds with growth substances. Already in 1936 Kholodnyi had recommended treatment of seeds with hormones before planting. The potentialities for increasing yields in this manner were so tempting that similar tests were made by many people on different plants.

At first, information based on this work told of some increases in yields, but subsequent, more careful and broad studies showed that this path did not offer any prospects. We refer for confirmation to one of the last papers on this subject. Stewart and Hamner, (1942) had tallied field and vegetative engaged in on a particularly broad scale experiments/by the US Bureau of Plant Industry. Seeds were treated with different growth substances in liquid form and also mixed with talcum. The most diverse plants were subjected to this treatment for better yields: radishes, oats, turnips, sugar beets, soya, squash, carrots, buckwheat, corn. Tests were conducted on many soils and under different climatic conditions. Their conclusions agreed with those of many other studies: treatment of seeds by growth substances did not influence growth and yields of cultivated plants to an appreciable extent.

At the present time, this negative conclusion can be explained from a theoretical standpoint. According to data agreed upon by many writers, seeds themselves contain ~~considerable amounts of~~ a large amount of growth substances. Kholodny in 1935, applied moistened pieces of corn endosperm to one side of an oat coleoptile and obtained significant growth curvatures. If seeds are rich in growth substances on their own, (Hatcher, 1945), adding more of the latter is superfluous and at times even harmful. Among many other attempts to influence plants, we began (1943) to study the influence of growth substances upon yields of alfalfa seeds.

The first tentative tests were made in 1943 at the Kirghiz Selection

Station on widely spaced rows of field planting of 3-year alfalfa "Tokmakskaja". The plants were sprayed in the evening with a solution of indolacetic acid on one blooming variant, and on another in the fruiting stage. Concentration of the solution was 0.0001 percent.

Spraying was done with a garden sprayer; 1 liter of solution to 1-m² (1 sq. meter). Because of their poor solubility in water, growth substances were first dissolved in small quantities of ethyl alcohol and water was then added to the solution up to the necessary volume.

The estimate of yield of seeds from one linear meter, repeated three times, is presented in table 1.

Table 1.

Period of spraying	Yield of seeds			
	for one shoot		for one linear meter	
	g	per cent	g	per cent
June 5 during bloom	0.41	153	49	169
June 18 during fruiting	0.28	87	29	100
Control	0.32	100	29	100

At a later treatment (at the beginning of fruiting) no increase in the production of seeds was observed. The report concerning this variant indicated that it was maintained under less favorable conditions with regard to watering. The last result required therefore further checking.

The success of the tentative experiment prompted further work in this direction. In 1944 a field experiment was again conducted at the Khirgiz Selection Station but on another wide-spaced planting area of 2-year alfalfa "Tokmakskaja", on the second mowing. This year a higher concentration of indoleacetic acid (0.005 percent) was used. Spraying was done with a solution of 70 cc to 1 sq. meter. This was done twice, during budding, on June 19,

and during blooming, June 29. To prevent rapid evaporation of the solution, spraying was done in the evening.

The action of growth substances was determined under different watering conditions; the number and periods of watering varied.

Figures are presented in table 2. It may be seen that treatment of alfalfa with growth substances resulted in a substantial increase in yields of seeds.

Table 2.

Variants of Test	Yield of Seeds			
	For one shoot g per cent		For one linear meter g per cent	
No watering	0.24	195	20	200
One watering (bloom)	0.33	86	32	110
Two waterings (budding and fruiting)	0.35	175	35	233
Three waterings (budding blooming and fruiting)	0.39	179	32	159
Four waterings (growth, budding, blooming, fruiting)	0.50	138	51	159
Average	0.36	140	34	162

Even during lack of water, treatment with growth substances had affected increase in yield of seeds.

In 1945 tests were laid in two places: At the town of Frunze, in field tests, and at Moscow in vegetative tests. At the Khirgiz Fruit and Vegetable Experiment Station, field tests were performed on a two-year wide-spaced row planting of alfalfa "Tokmakskaya". Success in work with growth substances depends in considerable measure upon the concentration of the solution. One of the tests studied therefore the influence of indoleacetic acid in different concentrations. Plants were sprayed at the beginning of bloom on the first

and second mowing. Three concentrations were tested: 0.005 percent; 0.0005 percent; 0.00005 percent. The data is presented in table 3.

Table 3.

Variants of test	Weight of seeds of first mowing				No. of seed pods of alfalfa of second mowing			
	On 1 shoot		On 1 linear meter		On 1 shoot		On 1 linear meter	
	g	percent	g	percent	Items	percent	Items	percent
Control	0.38	100	29	100	54	100	5184	100
0.00005 percent	0.44	116	28	98	53	98	5777	111
0.0005 percent	0.86	230	72	248	66	122	6666	130
0.005 percent	0.35	91	26	88	66	122	7392	142

Remark: Because of injury caused to alfalfa by the beetle, [Phytonomus variabilis Herbst.], the yield of the second mowing was estimated by the number of seed pods ("bobiki").

The optimal concentration of indoleacetic acid in the first mowing proved 0.0005 percent, in the second 0.005 percent and 0.0005 percent. A higher concentration of the solution for the second mowing is apparently less dangerous, since shoots are tougher by that time.

The choice of preparation is of considerable significance for the efficacy of growth substances. At Frunze, naphthylacetic, indolebutyric and indoleacetic acids were used; (Table 4). Plants were sprayed at the beginning of the blooming period.

Solutions of 0.005 percent of indoleacetic, indolebutyric and naphthylacetic acids failed to increase the yields of seeds of alfalfa of the first mowing. At this high concentration it was not possible to compare the activity of the different growth substances.

Table 4.

Growth substance and its concentration	Yield of seeds from 1st mowing				No. of seed pods on 1 shoot from 2nd mowing	
	One shoot		one linear meter		Items	percent
	g	percent	g	percent		
Control	0.38	100	29	100	54	100
Indoleacetic acid 0.0005 percent	0.85	226	72	248	66	122
Indoleacetic acid 0.005 percent	0.35	92	26	90	67	122
Indolebutyric acid 0.005 percent	0.33	87	29	100	37	70
Indolebutyric acid 0.0005 percent	-	-	-	-	116	215
Naphthylacetic acid 0.005 percent	0.40	105	37	128	51	95
Naphthylacetic acid 0.0005 percent	-	-	-	-	96	178

It follows from the above data that indolebutyric and naphthylacetic acids possess the best "prospects" for treating alfalfa during blooming.

Of importance for the efficacy of growth substances upon the yield of cultivated plants is the proper selection of the period of spraying. The first tests revealed already that treatment should be applied at the blooming stage. By spraying fruit trees at the proper time, it is possible to prevent fruit drop in apple trees. Following spraying, fruits of many varieties are retained more securely on their branches because of the delayed formation of the separating layer of the peduncle (Tumanov, 1946). Spraying was also used towards the end of fruiting of alfalfa to determine the possibility for reducing losses of seed pods in harvesting. It was proposed to increase the stability of attachment (prirostanie) of young fruits.

In spraying with the solution indoleacetic acid (concentration 0.005 percent)

on wide-spaced rows of bunched and nest-like plantings of alfalfa, we did not establish substantial differences in the action of growth substances for various methods of planting. Table 5 therefore presents only average figures on sprayings of alfalfa with 0.005 percent of indoleacetic acid during different stages of development.

Table 5.

Periods of Spraying	Harvest of seeds				No. of "bobiki" (seed pods)			
	1 shoot		1 linear meter		1 shoot		1 linear meter	
	g	percent	g	percent	g	percent	g	percent
Control	0.05	100	34	100	71	100	5215	100
Beginning of bloom	0.79	120	51	148	84	118	6354	121
Beginning of fruiting	0.77	118	44	129	60	84	4978	95
End of fruiting	-	-	-	-	77	108	5633	108

Here spraying was also most effective during the blooming stage in both the first and second mowings.

It was important to verify the possibility for increasing yields of seeds of alfalfa by treating plants with growth substances in other regions as well. This was done in Moscow in 1945, where vegetative-and not field experiments were set up.

For the treatment of plants triiodbenzoic acid was used, in addition to indoleacetic and naphthylacetic acids.

According to Zimmerman and Hitchcock, (1941), this substance possesses a "formative" action upon plants. In using a solution of this substance, Tumanov and Lizandr (1946) radically altered growth of alfalfa. It was interesting to establish whether "formative" substances were capable of increasing yields of alfalfa seeds. The preparation triiodbenzoic acid was synthesized for us through the courtesy of A. E. Guseva of the Institute of Biochemistry

of the Academy of Sciences of USSR. During the Moscow experiment a change in method was introduced. It was of interest to establish the influence multiple treatments by growth substances have on the same plants. 8 to 10 sprayings were therefore applied every five days.

The results of the experiment with 2-year alfalfa, Ukrainskaia blue No. 257, are presented in table 6.

Table 6.

Growth substance and its concentration	Dry weight of aboveground vegetative parts on one shoot		Yield of seeds per shoot		Weight of 1000 seeds	
	g	percent	g	percent	g	percent
Control	2.6	100	1.4	100	1.86	100
Indoleacetic acid 0.0005 percent	2.5	94	2.1	150	2.16	116
Indoleacetic acid 0.005 percent	4.3	165	2.3	164	2.14	115
Triiodbenzoic acid 0.0001 percent	2.5	94	1.6	114	2.01	108
Triiodbenzoic acid 0.001 percent	3.2	123	2.7	192	1.96	105
Naphthylacetic acid 0.005 percent	3.2	123	0.9	64	2.15	116

Figures obtained from vegetative experiments indicate that spraying with growth substances increased visibly the yield of seeds of alfalfa. Indoleacetic acid in concentrations of 0.0005 - 0.005 percent increased seed production by 50-64 percent. The "formative" substance, triiodbenzoic acid produced an equally positive influence upon the yield of seeds. A comparison between the concentration of triiodbenzoic acid of 0.0001 percent and 0.001 percent revealed that in treating alfalfa with the latter substance the yield of seeds was increased 92 percent.

The latter concentration affected the "formative" action upon alfalfa

at a concentration of 0.025 percent; weaker solutions of this substance failed to produce visible changes.

The highly active naphthylacetic acid was applied in too strong a concentration (0.005 percent) and as a result the yield of seeds was reduced by one third.

A comparison of experiments indicates that repeated treatments are not necessary. A single spraying, if properly administered, increases the yield noticeably.

In addition to alfalfa, vegetative tests were performed in Moscow in 1945 with butyric flax, running beans (Lopata) and summer wheat, Lutescens 062. In table 7 the results of the influence of indoleacetic acid upon the yield of flax ("Kudriash") (curly flax) are presented. (Weekly spraying with a solution of 0.0005 percent beginning with the blooming period).

Table 7.

Conditions under which tests were made	No. of bolls on shoot			Yield of ripe seeds per shoot			Weight of 1000 seeds	
	all specimens	percent	ripe specimens	%	g	percent	g	percent
Control	13.9	100	12.6	100	0.60	100	6.10	100
0.0005 percent of indoleacetic acid	21.7	156	14.6	116	0.77	128	6.80	111

It will be noted that spraying with growth substances of plants during their blooming period increased the yield of flax seeds by 28 percent.

The experiments were conducted simultaneously with those made with running beans. This object was of interest to us because the latter is a plant of abundant growth but poorly fertilizing beans. Only one experiment was made in this instance, the plants being treated weekly with a solution of 0.005 percent indoleacetic acid. The results are seen in table 8.

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Table 8.

Conditions under which tests were made	Dry weight of plant		Total length of plants		No. of inflorescences		Dry weight of beans	
	g	percent	cm	percent	specimens	percent	g	percent
Control	86.2	100	1267	100	31	100	38.6	100
0.005 percent of indoleacetic acid	97.8	113	1551	122	37	119	31.7	82

Under treatment the yield of beans reduced, but the vegetative growth increased by 22 percent and the dry weight of plants in a slight measure. It was not possible to increase the percentage of fertilized beans.

In working with wheat we tried to obtain a more productive stalk by applying growth substances. Spraying with growth substances was done weekly during stalk formation and four times between the booting and blooming stage. The results are presented in table 9.

Table 9.

Conditions under which experiments were made.	No. of stalks per plant		No. of grains per 1 stalk		Weight of 1000 grains		Yield of grain per plant	
	speco.	per cent	speco.	per cent	g	percent	g	percent
Control	5.4	100	24.2	100	36.7	100	4.8	100
Indoleacetic acid 0.005 percent	6.1	113	22.8	94	34.5	94	4.6	100
Triiodbenzoic acid 0.001 percent	4.4	82	23.5	97	40.5	110	4.1	85
Triiodbenzoic acid 0.01 percent	4.8	89	23.7	98	39.0	106	4.4	91

As seen above, the application of indoleacetic and triiodbenzoic acids did not increase yields. This result may be compared with other data obtained from publications on weed control, achieved through growth substances,

(Hamner and Tukey), (1944); Slade, Templeman and Saxton (1945).

Considerable variation in the sensitivity of plants to growth substances was established. Among all plants the group of cereals, cultivated, as well as uncultivated (weeds) and meadow crops radically stood out. They proved completely non-sensitive to growth substances. Even strong solutions of acids which easily destroy weeds did not have any effect upon cereals. It is to be stressed, nevertheless, that triiodobenzoic acid led to an increase in the size of wheat grains. Treatment with growth substances increased the weight of 1000 grains to 39.0 - 40.5 g, as against a control weight of 1000 grains equalling 36.7 g.

We further established that an increase in yield following treatment with growth substances is accompanied by an improvement in the quality of seeds.

Several American and British researchers sprayed plants during their bloom with growth substances. They succeeded in obtaining positive results with tomatoes, strawberries and blueberries.

In the USA tomatoes were sprayed first during their blooming period to obtain seedless fruits.

In the process of the work it was noted that tomatoes treated with growth substances developed a larger number of fertilized fruits. In addition, their initial growth was more rapid. As a result of the increase in yield the number and size of fruits also increased. Thus in one experiment an increase in yield of 33-30 percent was obtained from spraying tomatoes (winter) and their fruits were larger in size. (Burneck Wittwer and Hemphill, 1944). Because of the earlier germination of fruits and their faster initial growth, the first ripe tomatoes were obtained two weeks earlier.

Increase in yield, as a result of the increase in percentage of fertilized berries, following treatment with naphthylacetic acid, was obtained in straw-

berries (Swadrick, 1943). In blackberries, spraying with liquid solutions of naphthoxacetic and chlorphenoxyacetic acids increased the size of the berries 43-99 percent (Marth and Reader, 1944). Thus foreign researchers were able to increase production of tomatoes and some berries, while we demonstrated the possibility of raising yields of seeds with the aid of growth substances among field crops, alfalfa and flax.

The number of flax seeds on a plant increases radically following treatment with growth substances. Upon forming a certain number of bolls the flax plant (untreated) discontinues its growth and formation of new buds and gradually dies. Treated plants, on the other hand, act altogether differently. Their growth and the appearance of buds do not stop. The size of seeds is also increased, as in the case of alfalfa.

All available data indicates that increase in yield, resulting from treatment with growth substances, takes place at the expense of the formation of the number of flowers and inflorescences, fertilized specimens and fruits, and strengthening of fruits and seeds. Future study of the theoretical bases for the increase of yields through application of growth substances will not only assure the practical use but also permit penetration into the inner life of plants and extend our knowledge of physiology.

The experiments were performed at the city of Frunze (1943) by the scientific assistant, A. E. Frenke, the candidate in science, S. G. Enikeev (1944 and 1945), and the scientific assistant, A.A. Lizandr, Moscow (1945). The plan, method, supervision and literary presentation were the work of I.I. Tumanov.

CONCLUSIONS

1. Three-year field-and vegetative experiments with alfalfa revealed the possibility of increasing the yield of seeds of alfalfa by spraying the plants with a liquid solution of growth substances.

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2. Among the tested solutions indolebutyric, naphylacetic, and triiodbenzoic acids proved most effective. Plants may be easily injured by an incorrect concentration. In our experiments, solutions of 0.0005 percent of naphthylacetic, indolebutyric and indoleacetic acids proved most effective. A higher concentration was required in the case of triiodbenzoic acid (0.001 percent).
3. The best time for spraying proved to be the period of blooming.
4. Frequent sprayings did not increase the action of growth substances. Evidently, one or possibly two sprayings are adequate.
5. Spraying during blooming with a solution of growth substances may increase the yield of other plants as well. Positive results were obtained in the case of butyric (oil) flax. It was not possible to achieve any increase in the yield of summer wheat by this method.
6. Increase in yields by treating plants with a solution of growth substance is based upon the increase in the number of flowers on a plant, the percentage of fertilized seeds, the size of the latter, and the growth of vegetative vigor in plants.

End of Article.

ANF
August 30, 1951.

IAKUSHKIN, I. V. I

Transl. 199: Sugar Beets

Iz mnogoletnikh rabot po selektsii
svekly na Ramonskoi stantsii.

SE144

(From work of many years on sugar
beet selection on Ramon station).

Vsesoiuzn. Akad. Sel'skokhoz. nauk
im. V. I. Lenina. Dok. 1947. (11):
20-22. 1947. 20 Akl.

Translated from the Russian by R. G. Dembo

At the thirtieth anniversary of the Great October Socialist Revolution were completed 25 years since the work on sugar beet selection on Ramon experimental station started.

In determining the problems of sugar beet selection, when the station was founded, we pointed out the following:

1. The existing methods of sowing sugar beets based upon the non productive consumption of large seed masses require improvement, specialization and reprocessing according to the basic aim of the sowing: the acquisition of material for the plant, mother (foundation) material, reproduction material, selection material.

2. The sowing of selection material has to be carried out by various methods of two basically different purposes: for evaluation and for reproduction.

3. For the industrial plantations as well as mother (foundation?) plantations the sowing method with interruptions (broken, pointed) is recommendable for experiment during which the normal density of the rows could save up to 50% of the seeds. A special application of sowing machine in the direction of returning half of the seeds in the seed box for a second sowing.

4. For mother (foundation) plantations it would be necessary to recommend a more regular distribution in both directions, or, it would be necessary to decrease the distances between the rows up to 27 cm, by increasing them within the rows up to 18-20 cm (instead of 36 and 12-15), aiming to the square form (the form accepted for selection nurseries). By keeping the previous density

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within the rows, this measure would lead to the extermination of a smaller amount of plants, with the decrease of density, it would lead to an increase of the root.

5. For mother plantations the sowings of small density (around 20 pounds of seeds for "desiatina" [2.70 acres]) should be taken under experiment.

6. The ideal distribution and even sprouts, necessary for selection nurseries (destined for a repetitive selection), in the Eastern raion, with a dry spring, are impossible for manual sowings. It is necessary to equip the stations with small sugar beet sowing machines.

7. For original selection plantations, it is necessary to care not only about the regular standing, but about a free development of separate plants as well, which leads us to interruptions on long distances and simultaneously to the drawing together of the rows, therefore a machine sowing with the succeeding square distribution of plants is imperative.

8. The individual registration on individual plants permits the carrying out of study of varieties (relative infinitesimal) on a small amount of nests, summing up the division to one root and increasing the number of repetitions up to 100 or 150. By this amount of repetitions, a high degree of accuracy is ensured (the possible error below 1.5 percent). The reproduction of valuable posterity should be carried out independently from the rare machine sowing with the most limited interruption.

During the years of founding the station, its activity was considered of little use for the sugar beet plant in general, and especially for the production and cultivation of selective varieties of sugar beets which would be valuable for somewhat wide part of sugar beet belt. The availability of large quantities of nitrogen and humus in Voronezh black soil, the short warm period (late spring and early fall) forced the farmers to produce varieties

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which ripen quickly and varieties with a small amount of nitrogen. But the selective methods for quick ripeness were unknown at that time and the possibility of changing the chemical structure by selective method was doubtful. In one of the succeeding reports, in 1928, we observed that the Ramon station, as the most Eastern of sugar beet stations, has been called to produce local varieties of sugar beets adapted to various climatic and soil conditions. We then pointed out that, if there are no raion varieties of sugar beets, we must produce them.

Already during the first years of selective work at the Ramon station was indicated the possibility of high saccharinity and of high weight of the root. At the same time in Western Europe the achievement of such a valuable combination was denied.

During the succeeding period of the station's activity the point of view, that the sugar beet plantations near Voronezh are able to produce only sugar beets whose characteristics are: the low weight of the root and small saccharinity, has been rejected.

When the Ramon station has been founded and during the first decade of its activity, when I was supervising it, in sugar beet selection I considered as most important the following basic positions: 1) the development of selection according to the complex of characteristics; 2) production of varieties with a low percentage of general and harmful nitrogen in the roots; 3) the utilization of their second year for selective purposes (the planting year, according to my point of view, is irreplaceable for the solution of a series of problems, especially for the production of early ripening varieties); 4) the application upon selection fields of wide food fields which promote the sprouting of individual peculiarities of plants. According to our opinion, it would be quite important to combine the selection for the structure with the formation

of varieties or of materials not only of high quality, but for good conservation as well.

During the succeeding three Five-Year-Plans the selective work with sugar beets which are carried out at the Ramon station under the supervision of the outstanding selectioner, the laureate of Stalin's prize, Avedikt Iak'ianovich Mazlumov, gave outstanding results. In the state testings with varieties the Ramon varieties occupied the first place many a time, leaving behind a series of other first-class Soviet varieties.

The Ramon varieties are the varieties of wide Belts. They are growing as far East as Altai krai, and in the West, - on the Right shore of Dnepr.

At the present time the Ramon varieties occupy the fourth place of sugar beet plantations in the Soviet Union. At the Ramon station is recorded the supremacy of seed blendings which are the product of intervariety crossing.

The selection of materials for such hybridization is one of the most perspective methods of sugar beet selection (according to the analogy with corn and rye).

Mazlumov also determined that the winter sowings are a perfect means for the elimination of the blooming forms from the varieties. He also worked out methods for long conservation (two winters) of sugar beets for the production of varieties immune to fungi and bacterial diseases.

Good progress was achieved by the station in the crops of sugar beets seeds. Under the supervision of Mazlumov were successfully developed the experiments in pinching which started at the station already in the twenties. Mazlumov also indicated that the best results are obtained by the cutting off the upper bud in fall.

The Ramon varieties distinguish themselves by high seed productivity, by large seeds, and some of them (No. 1537) by large cotyledons. The Ramon varie

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ties are characterized by high evaluations in industrial posterity. Thereby is confirmed the expediency in the reconstruction of the sugar beet structure with the transition from a great amount of varieties to a limited number. But the control of many variations in sugar beet production is still in elementary stage. Meanwhile, one of the results of the work of Ramon station for a quarter of a century is the conclusion of the necessity of shifting from the yearly production of new varieties to the improvement of the best varieties into genuine varieties which should undergo systematic improvements, but should not change yearly. With such a reconstruction there is no necessity in carrying out selection work on sugar beets at several neighboring stations, for instance, at the stations of the right shore of the Dnepr. Some of these stations could be assigned new tasks with other plants, and for the perfection of sugar beet varieties five stations would suffice instead of ten, with the conservation at sugar beet stations of that wide scale of work which has been and still remains typical for the Soviet sugar beet system.

At the thirtieth anniversary of the October Revolution the Soviet sugar beet selection is able to evaluate proudly the results achieved by it. Many Soviet varieties are higher than those from abroad.

L.A.B.
9-4-51

SAVCHENKO, E. N. The new sugar beet pest.
Sovet. Agron. 5(5): 66-68. May 1947. 20 So84.

Transl. 200: Sugar Beets.

SB108

Translated from the Russian by R. G. Dembo.

Until recent times the sugar beet undermining "miniruiushchaya" moth was known only in the countries of Southern Europe (France, Spain, Italy), in the Near East (Turkey, Palestine) and in Northern Africa (Egypt, Morocco).

In USSR its individual nests were first disclosed in 1945, in Kranso-darsk krai; in summer of 1946 it embraced the entire sugar beet zone of Kuban'. On the majority of fields the moth had infested from 80-100 percent of the plants; in the more infested South-Eastern part of the krai the amount of the moth caterpillars reached a few dozens for one sugar beet root. On individual farms, already at the beginning of June, 8 percent of sugar beets were destroyed by moth caterpillars.

The study of the biology and of control measures against the moth under the conditions of USSR was almost equal to zero, which fact increases the danger for our national sugar beet sowing.

The undermining sugar beet moth is a small, insignificant moth which is 12-14 mm wide in the wing-spread; on its reddish gray front wings there are several black, eye-like spots, and the wide tail wings are gray and are edged with fringes of long, densely set bristles. The mature moth caterpillar reaches 12 mm. in length, is green, with a light head and with characteristic long pink lines upon the sides of the back. Externally it reminds partly the caterpillar of the well known cabbage moth, [diamondback moth, Plutella maculipennis].

In the caterpillar stage, the pest winters upon sugar beets in separate plants which remained undug, in sugar beet waste after harvest, on the surface of the ground and in the upper layer of the soil. The cocooning of caterpillars occurs early spring, in the place where they wintered. The butterflies

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of the first generation fly out from the cocoons in the middle of April; their flight lasts about one and a half months. The active life of the moth begins in the evening, before the sunset, and lasts up to sunrise; at night the moth likes to fly towards light, during the day it hides in rosettes of plants, under the soil and in cracks of the ground; the frightened moth flies suddenly away and hides again. The protecting dark color makes the moth almost unnoticed upon the surface of the soil.

The second generation of the moth flies out in the period between June 10 and 20th, the third - during the second half of July and the fourth - at the end of August; based upon the comparison of the climatic conditions of Krasnodarsk krai with the climate of other countries, where the biology of the moth has been studied, it is possible to expect in Kuban' the development of the fifth generation of this pest.

The sugar beet moth begins its egg depositing soon after the flying out of the butterfly from the cocoon; one female is depositing 10-100 eggs, at the approximate average 25-40; very tiny pearl-white eggs of the moth are distributed individually or in small groups on the sugar beet rosette, upon the petioles and on the leaf bases, or some times directly upon the ground.

The sugar beet moth is capable of depositing unfertilized eggs which are able to produce life-ready caterpillars whereby the energy of its propagation increases considerably.

Due to the intensive propagation of the sugar beet moth, in places where at the beginning of summer it is hard to find any traces of it, after 1-1 1/2 months already 60-70 percent of plants could be already infested by it.

The moth caterpillars appear from the egg on 4-7th day after their depositing. The upper leaflets become interwoven by a web around the buds into a compact nest, in which a few caterpillars of the moth (some times 8-10),

which feeds on the bud are hidden. The damaged plants are easily noticed due to the blackening of the flower buds, and later, after the destruction of the buds, at the sprouting of numerous secondary flower-bearing stems which change the entire appearance of the bush. On the flowering seed-bearing parts, the caterpillars damage flower-bearing stems, which deform on account of that and become yellow above the damaged place, and individual green tubers into which the young caterpillars penetrate; the damaging of mature tubers has not been noticed as yet. The leaves and the petioles of the seed-bearing plants are damaged more seldom.

Upon the sugar beets of the first year the moth lives and feeds itself first between the web of the covered leaves or under the turned edges of the leaves; the damaged leaves usually become black. Many caterpillars immediately penetrate into the leaf tissues, breaking winding mines into the tissues; the young caterpillars undermine the central veins and the petioles of the leaves more seldom. According to their growth, the caterpillars disclose a tendency to go down upon the root tip; here they damage the bases of the leaf petioles, sprinkle the root tip and often penetrate into the top at several cm, gnawing through its long passages, which are filled with excrement.

The sugar beets of the first year, damaged by the moth caterpillars, stop growing, the leaves blacken and then rot and die; some times upon the damaged plants 1-2 leaves are left. As the result of the inner damage of the top which facilitates the infestation of the root by various disease organisms, is the incapacity of the root for conservation after the harvest, and the root's rotting in the field, which results in the rotting of the entire top.

For the young sugar beet in the stage of 3-4 leaves, the appearance of 4-5 caterpillars upon one plant is critical; for the mature sugar beet during the period of closing the rows - 24-25 caterpillars are critical.

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According to the data of foreign literature, the saccharinity of the sugar beets damaged by the moth is able to decrease at 25 percent as compared with the normal beets.

The caterpillars of the undermining sugar beet moth damage the fodder and the eatable beet as well; under natural conditions, the caterpillars obtain their nourishment from the wild sea beets. The undermining sugar beet moth does not develop upon the goosefoot family [Chenopodiaceae] nor upon the amaranthaceae families. Its caterpillars, when placed upon those two species, perish of starvation not touching these plants. Therefore, in Krasnodarsk krai, where the wild sugar beet grows very seldom, the only food for the caterpillars are some sugar beet roots which are left undug, and which started to sprout. The moth infests, apparently, the normal plant of the seed-bearing sugar beets only from the moment of plant sprouting, and the sugar beet of the first year, after the appearance of 3-4 pairs of leaves upon the plants.

The caterpillars of the sugar beet moth finish their development and cocooning after 20-30 days after their appearance from the eggs; during this period they pass five stages; during starvation, the caterpillars of the third and the fourth stages are able to cocoon. The cocooning occurs in a loose silk cocoon upon foddering plants or in the soil nearby. The cocoon stage lasts 7-14 days.

Thus, in the Krasnodarsk krai upon the development of the undermining sugar beet moth, a few species of the ichneumon-fly [aphelinid parasite, Prospaltella berlese] are parasiting, but this infestation did not exceed 20 per cent during the summer of 1946; now the insignificant mortality of the caterpillars of some other definite disease could be noticed.

The basic measure in controlling the undermining sugar beet moth is the preventative measure. Into the complex of fall-winter preventive measures are

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included: the preliminary digging, the removal from the field and the delivery heavily damaged sugar beets of the ~~sugar beets heavily damaged~~ to the industrial organizations. The infested sugar beets should be reprocessed at the plants in the first place, regular and forage beets which did not lose its nourishing and forage value should be utilized without leaving it in the ground too long. In connection with this, the packing of the beets into "kagats" and "burts" requires a strict scrutiny of the infested tubers.

Not a single sugar beet tuber should be left in the field; even a short conservation of the infested sugar beets in field heaps is undesirable. The sugar beets infested by the moth caterpillars could be cleaned by frustum or by straight cut. The cleaning of the sugar beet at a frustum decreases the infestation of the fields, destroying a great amount of caterpillars. On the other hand, in this case there is a risk that the spreading of the caterpillars from the roots during their conservation in the field, during transportation, loading at supply stations, during the packing into "kagats" and "burts" and their conservation. If the sugar beet is cut straight, a great amount of caterpillars which are in the tops penetrates into post-harvest waste and could be easily removed from the field, but the gross gathering of the sugar beet raw material decreases.

Disregard the measures of cleaning sugar beets, it is necessary to gather thoroughly all the post-harvest waste at the end of each labor day, remove it from the field, and feed the cattle with it, or silo it, and in some cases, where it is impossible to destroy it, to dig it into the ground at the depth of not less than 0.5 m. It is recommended that the waste which is thrown into a pit should be poisoned by polychlorides of benzol or be covered with calcium oxide; during the charging of unpoisoned pits it is necessary to pack it thoroughly.

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Immediately after the digging of the sugar beets, the infested field should undergo a thorough plowing with the obligatory application of plowing machines which would ensure a complete turn of the soil.

Besides of the sugar beet waste the mother sugar beet could be the source from year to year for a repetitive infestation of the fields by the undermining sugar beet moth. Taking into consideration the threat of moth and the relatively small specific gravity of the Kuban' sugar beet seed production, according to the general scale of the Union, it is appropriate to discuss the problem of temporary interruption of sugar beet production in Kuban'. In the future, the method of disinfection of the roots of the mother sugar beet by means of spraying gaseous insecticides should be tested as applied to our conditions. This method of controlling moth would permit the planting of sugar beets by non-infested roots (tubers).

In case of preserving some sprouts in sugar beet crop rotation, it is imperative to isolate them locally from the sugar beets of the first year. This might be accomplished by means of planting the tubers into the field of crop rotation. The expediency of such measure is confirmed by the fact that the butterflies of the undermining sugar beet moth do not fly far, due to which the sugar beet of the first year is less infested the farther it is from the old sugar beet field. The isolation of the first year sugar beet plants is expedient also in the interests of controlling the disease of sugar beets through "peronosporoz".

During the spring-summer period among the preventive measures in controlling sugar beet moth, all general agrotechnical measures which increase the immunity of sugar beets to damages should be utilized, a thorough loosening of the soil between rows, and also the removal and the destruction of individual infested plants or of their parts during the appearance of the first caterpillars of the moth in the field.

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Among the chemical measures, the spraying of sugar beets during the period of the moth flight by a 0.5 percent emulsion of the compound EDT, gave good results. The spraying with the compound DDT and the application of regular contact and intestine insecticides was ineffective.

The fact that the undermining sugar beet moth has been discovered only in Krasnodarsk krai which geographically has been isolated from the rest of the zone of the sugar beet sowing in the Union, compel us to pay more attention to the quarantine measure. Krasnodarsk krai should be placed under quarantine; the export of living non-conserved and non-fumigated tubers and seeds of all varieties of sugar beets beyond the borders of the krai, and also samples of soil should be completely prohibited. By means of quarantine of the Ministerium of Agriculture of USSR, it is imperative to inspect in the shortest time all the oblast's and republics which are close to Krasnodarsk krai as far as the undermining moth is concerned; all those places should be inspected where this pest is spreading, at the expense of regular and forage sugar beet.

Unfortunately, the system of measures in controlling the undermining sugar beet moth which has been suggested by the All-Union Scientific-Research Institute for Sugar Peets already in 1946 has not yet been confirmed by the Ministeriums involved and has not been realized in practice.

Despite the fact that the sugar beet in Krasnodarsk krai practically "burns" of that moth, the technical measures necessary for the strengthening the control of the moth have not been imported as yet.

We can not tolerate such a situation any longer. If, in the very near future, the situation will not be changed, then will the sugar beet production be endangered not only in Kuban', but in other raions of our Union as well, where the sugar beet moth is able to spread easily.

The elimination of the undermining sugar beet moth is not a local, but an All-Union task.

Transl. 201: Sugar Beets

Orlovskii, N. I. (Professor)

-Selection of sugar beets in USSR. Selek. i Semen. 14(12): 32-38. Dec. 1947. 61.9Se5

Department of Agriculture
SQ-156

Translated from the Russian by S.N. Monson

Prior to the Great October Socialist Revolution there was not a single scientific-research institute in Russia for the study of sugar beets and sugar beet production. Nor was there any planned organized chain of selection stations. The few in existence were privately owned and spread without plan, chiefly on the area of the so-called South-West krai; they supplied certified seeds of sugar beets for 25-30 percent of the entire sugar beet area which at that time amounted to slightly above 650 thousand hectares.

A considerable part of sugar beets was ~~imported~~ planted with imported seeds, purchased for gold valuta, or with local reproductions of imported seeds. Only few sections were planted with local "non-varietal" seeds of sugar beets. The principal task in the first years of Soviet rule was consequently to establish a domestic selection-seed industrial chain, provide it with personnel and modern technical equipment.

In the first two to three years the chain of selection stations and volume of varietal work were reviewed and reorganized; ~~varietal work~~ potentially best selection stations^{work} extended and equipped anew (Uladovsk, Verkhniachesk, Ivanovsk).

Simultaneously, advanced special courses were organized for selectors to train them as specialists for these stations. In 1922 the Scientific Institute of Selection began work at Kiev; it was subsequently named the All-Union Scientific-Research Institute of Sugar Beets. Its staff, jointly with the Varietal-Seed Administration of Glavsakhar (Chief Administration of the Sugar Industry), developed standards for the sugar beet seed industry and other crops under sugar beet crop rotation. These plans in varietal production

received the approval of several all-union conferences held between 1922-1925, in which the foremost specialists-selectors of the Soviet Union participated.

A special chain was organized for so-called collective varietal testings of sugar beets (similar to Government testings) to decide upon the choice of the most valuable local initial stock in further varietal-industrial work. The highest grade varietal stock was widely propagated in a short space of time to meet current needs of the beet seed industry. Laboratories of the Institute (Kiev) studied selection, anatomy, physiology of sugar beets and other agricultural crops. Major achievements performed in varietal work on sugar beets in the first few years were:

1. Reorganization of varietal-industrial seed chain to conform with the needs of the sugar beet industry and the organization of two new stations: Belo-Tserkov and Ramona.
2. Development of standards of Soviet sugar beet varietal industry; Establishment of best initial stock; acceleration in propagation and improvement of elite seeds of sugar beets;
4. Complete independence of sugar beet plantings from foreign sources and discontinuance of imports of mother varieties of sugar beets from abroad;
5. Development of many theoretical problems on selection and the biology of beets and other crops under sugar beet crop rotation.
6. Training of highly skilled personnel as selectors;

Subsequent tasks in varietal production consisted primarily in solving problems connected with the Stalin 5-year plans of that period. The principal tasks with respect to sugar beet varieties were:

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- a) further development of beet planting in the principal areas, particularly the new regions (Northern Caucasus, TSCHO, Povolzhie, Western Siberia, Central Asia);
- b) increase ~~of~~ gross of crops of sugar beets and improvement of their quality;
- c) extension of chain of selection stations;
- d) intensification of scientific research and improvement of sugar beet varietal industry.

In solving these aims, the All-Union Scientific-Research Institute of Sugar Beets together with farm organizations within its area accomplished the following:

Improved selection and seed growing based on the regional adjustment of varieties of agricultural plants, according to Darwinist principles, as against methods of cosmopolitanism advocated by Western European scientists who proceed from metaphysical concepts. Plans were developed to set up selection stations and in this connection the following stations were organized: Pervomaiskaiia, Veselo-Podolianskaiia, M'govskaiia, and Biiskaiia, and Frunze Point, in addition to 52 varietal plots.

Regional and Government varietal testing stations of sugar beets were also established. The organization of a chain of selection stations and varietal plots, according to a plan, and that of government and regional varietal testing points, permitted first to verify the regional adjustment of sugar beet varieties and secondly, to properly regionalize varieties and set standards for varietal changes. The introduction of scientifically regionalized crops into industry should, based on the most conservative estimates, provide the Soviet Union with no less than 1.5 centners in additional sugar from each hectare of planting.

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Multiple government tests of Soviet and the foremost foreign sugar beet varieties proved the superiority of domestic regionalized varieties which produce an additional average of 5-6 percent of sugar beets per hectare, compared to the majority of foreign varieties.

Special studies, as well as government and regional varietal testings in the USSR have now proved the insolvency of statements of foreign selectors asserting that the limit in sugar content has been reached in sugar beets and that it is impossible to combine high yield with high sugar content in one variety. In contradiction to this, Soviet Selection Stations have already transferred many varieties to industry that combine a high degree of productivity with a high percentage of sugar. Among the best representative varieties in this group are V-1513 and V-23 of Verkhniachski Station and L-1939 of L'gov Station. The Institute and selection station have developed a plan for preventing regression in sugar beet varieties in seed propagation and ensuring thereby their prolonged use in industry.

On the eve of the Great National War about 500 thousand centners of high grade varietal seeds were grown annually, an amount adequate to supply the area of sugar beet planting of the USSR, including the reserve fund; an amount which places the Soviet Union at the top in sugar beet seed world production.

Dozens of high grade beet varieties have been transferred to industry by many selection stations; the best varieties are:

Uliadov Station - U-1030, U-1555, U-1718 and U-552;

Verkhniachsk Station - V-1025, V-1408, V-1513, V-1612, V-23;

Belo-Tserkov Station - BTS-12-6, BTS-1750, BTS-1651, BTS-135;

Veselo-Podoliansk Station - V-P-206;

Ivanovsk Station - I-1305, I-1531, I-1745, I-502;

L'gov Station - L-1057, L-1650, L-1749, L-408;

Ramona Station - R-1537, R-47, R-306, R-407;

Pervo-Maisk Station - P-1544, P-473, P-475;

Biisk Station - B-151, B-309, B-541;

Frunze Point - F-234, F-302;

Ialtushkov Point - IA-476;

In the process of producing varieties many stations developed their original methods of selection, such as selection by seedlings, reaction to fertilizers (L'gov Station) selection according to biological characteristics (Ramona Station), etc.

The principal achievements in varieties of sugar beets consisted by the outbreak of the Great National War primarily in the following: the establishment of a varietal chain conforming to a plan, which included in addition to the leading Institute (VNIS), selection stations, selection points and several dozens of varietal plots. The need for pure seeds was thereby fully taken care of. Proper regionalization of sugar beet varieties was introduced into practice; and lastly major problems of the theory of selection and the biology of sugar beets were thoroughly studied.

At present VNIS and selection stations are engaged in a number of theoretical problems; these will be dwelled upon in this article in brief.

Individual, group and mass selection was developed on sugar beets; basic principles were established for inter-species, inter-varietal and intra-varietal crossings. Methods of selection and evaluation of sugar beets were developed according to special traits: speedy ripening, non-flowering, drought resistance, low content of harmful nitrogen and ashes, increase in superior quality, loss of woodiness, resistance to diseases (peronospora?, root-eater,

mound-storage rot, erysiphe?), reaction to different elements of nutrition and temperatures.

On the basis of T. D. Lysenko's theory of stage development of agricultural plants, a stage analysis for sugar beet varieties was developed. Definite production schedules were set up for every selection station, supposed to take into consideration ecological and industrial characteristics of the individual regions in sugar beet production.

Methods to speed selection were developed by planting freshly gathered seeds and seedlings in summer and fall and by making use of hothouses during the winter months.

The significance of agro-technical methods and crop rotation in varietal work and selection was studied. At present varietal work on sugar beets proceeds basically along the following lines:

A. SELECTION

Stages of work:

I. Selection of pedigree or super-elite groups in selection nurseries, their partial clonicity and development in nurseries and hothouses.

II. Growing of seeds from pedigree plants or their groups by mutual crossing.

III. 2-year evaluation (appraisal of descendants of pedigree plants at station varietal testing

IV. Propagation of more valuable descendants (numbers).

V. Additional evaluation of these numbers at station and regional tests on varietal plots. Formation of new varieties from record-breaking specimens.

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... for hypothesis of the B. SEED GROWING ...

VI. Initial propagation of a new variety to obtain elite seeds (mother seeds) and the simultaneous evaluation at regional varietal testing.

VII. Government test of mother seeds by ^{an} entire chain of varietal plots.

VIII. Secondary propagation: planting of mother beets of record varieties (on the basis of government tests) at seed growing state farms for the production of industrial seeds.

IX. Government tests of industrial seeds.

X. Delivery of industrial seed to collective and state farms.

The above division is naturally tentative since the process to improve selection is currently applied regularly. As a result of special expeditions and extensive contacts with scientific-research institutions numerous varieties of cultivated and wild forms of sugar beets were gathered and studied. The possibility of including forage and table sugar beets and mangolds was proved in practice, together with the use of many wild forms of sugar beets for enriching initial stock necessary for the production of varieties of higher yields and sugar content that also possess such special useful traits as drought and frost resistance, resistance to cercospora, mound-storage rot and other diseases.

Variability and regularity in the heredity of major utilitarian, morphological, anatomical and biological traits of sugar beets were studied.

The intermediary, dominant and heterosis type in heredity of sugar content was established. Standards and methods were developed for pair-dialyl, saturated, inter-varietal and intra-varietal crossings with regard to sugar beets.

... jointly with physiological and biochemical laboratory ...

A new hypothesis of the origin of cultivated sugar beets and the hybrid origin of beets (from ~~the~~ crossings between root-fruit and foliage beet-mangold) was developed, based on detailed universal study of the large variety of forms of beets, products of crossings. Regularity in the heredity of single and multiple seed of sugar beets (soplodia") and a new form in beets (single-seedling) were obtained.

The adoption of many forms of forage, table and uncultivated varieties of beets for purposes of hybridization permitted the development of new varieties of increased productivity and sugar contents that equalled those of cultivated beets. These hybrids are at present widely propagated in industry.

The laboratory of selection and genetics of VNIS, together with Frunze Point, developed methods for planting seeds of beets without transplanting for the benefit of the central-asiatic sugar beet regions. The cytology of beets was studied with reference to bloom, fertilization and the embryonic development of the plants. Causes of auto-sterility of beets were established; factors determining auto-fertility; methods and technique of artificial hybridization; methods of obtaining seeds by self-pollination from auto-sterile races; and the cariosity of the greater part of known species of the genus Beta.

Inter-species hybrids B. corolliflora, B. lomatozona, B. macrorhiza and B. trigyna of sugar beets were studied at the genetics laboratory. The laboratory of anatomy of VNIS conducted interesting tests to learn the inner structure of various crops and uncultivated beet forms; the development of sugar beets in the first and second years and their most important organs, i.e. leaf, petiole, root, stem and seed were studied in detail. These studies engaged in jointly with physiological and bio-chemical laboratories helped

establish many characteristics of root structure and their heads, connecting passages ("putei") which determine the movement of sugars and their transformation. Positive and negative points in root structure and uncultivated types of beets were also established for purposes of hybridization with cultivated species. Of major interest is the latest work of the laboratory of anatomy. The study of the transformation of chlorophyll grain, the anatomy of root and leaf growth and root of sugar beet when not transplanted, as well as the influence of vernalization and heat treatment of seeds upon differentiation processes of merismatic tissue, growth points of sugar beets, and finally, the influence of various elements in nutrition (P, K, F, etc.) upon the transformation of anatomic elements in beet growth.

Laboratories of physiology and biochemistry of VNIS studied processes of photosynthesis, watering, mineral nutrition, ~~breathing~~ of various beet varieties, sugar formation and growth under conditions of external environments. Many biochemical processes connected with fermentation of beets were studied extensively.

By applying original equipment and methods of research it was established that during noon hours and hot days the water balance of beets is disrupted because of the break between evaporation and supply of water from the soil; this is accompanied by a reduction in the absorption of carbon acid and its simultaneous escape connected with the loss of previously accumulated dry substances and retardation in growth.

By applying specially constructed equipment to the study of breathing processes, characteristics in breathing of different organs of beets in the various stages of their development were established under manifold conditions with regard to mineral feeding and watering. Varietal characteristics of

beets were also determined. Extensive studies of sugars in leaves and roots of beets were ~~also determined~~ engaged in, as well as beet growth under different mineral feeding and watering. The negative influence of nitrogen upon beet growth was determined prior to the photosynthetic action of its assimilating apparatus. The development of the latter which accelerates nitrous feeding, in necessary correlation with other elements of mineral feeding contributes to more virorous beet growth.

Important observations were made with respect to the distribution of sugars in different tissues of roots/^among the various forms of beets. Thus it was found that vascular knots of the inner root part of beets contained more saccharose than the corresponding layers of inter-node parenchyma.

In contrast mangold parenchyma contains more saccharose than do nodes? ("puchki"). Special studies of crossing beets with other root crops and beets with mangolds point to the possibilities of increasing the sugar content of parenchyma layers of beets at the expense of the absorption ("pospriatie") by hybrids of the corresponding characteristics of mangolds.

Of particular interest to selectors is the role of foliage and root in accumulating sugar in the root. Contrary to the fairly widespread belief that the root is "passive" in this respect and acts only as a source for the flow of sugar from leaves, special tests established that this is far from true. Tissues of roots, as was proved by biochemical study of grafts of beets upon forage and vice versa, actively participate in the formation and accumulation of saccharose in roots.

Extensive experiments have been conducted lately on sugar accumulation under different soils, climates and other factors of external environment. The role of harmful nitrogen and ashes is under study, as is the development of methods to reduce these substances in beets. It is particularly desirable

to stress the work of VNIS and its system of varietal work on beets during the Second World War. At the beginning of the war, in 1941, Uladov and L'gov stations were evacuated to Biisk Station, Altai territory. The remaining stations, including VNIS itself, were evacuated into Central Asia to Frunze Point, which became the main base for sugar beet production and sugar beet planting between the years 1942 and 1943.

Leading selectors and other specialists were also evacuated to these points together with the more valuable selection stocks. It is natural that during the war (before the Institute and stations returned) many special laboratories of the Institute and stations discontinued their operations and devoted their main attention to essential propagation of the evacuated stock and the provision of seed beet funds with the best varietal material.

Scientific staff members of the Institute and stations took active part in introducing sugar beet seed plantings at collective farms; an average yield of seeds was obtained in 1942 in the beet zone of Central Asia that amounted to 15 pods per hectare. Selection proceeded in addition on material received from all selection stations, selection nurseries, testing stations, planting plots of elite seeds, regional and government testing stations.

As a result of the devoted labor of all selectors, the evacuated seed stocks were not only saved but propagated to an extent which permitted the stations upon their return two years later to fully restore the pre-war schedule in their respective localities. Seed stock of industrial varieties of beets was also propagated to meet requirements in seeds of all sugar beet zones of the USSR in full measure, including regions freed from the temporary German occupation.

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In Central Asia new hybrids of VNIS beets were propagated along with forage and table beets and several uncultivated species. Considerable study was engaged in on the physiological and biochemical properties of beets in Central Asia, specifically, at Frunze and Issyk-Kul'sk oblasts and Uzbekistan. A new and effective method of planting sugar beet seeds without transplanting was developed jointly with Frunze Point. Fascist invaders caused enormous losses to Soviet varietal sugar beet production. The joint efforts of selectors and biologists under the leadership of the Party and Government succeeded nevertheless to heal the wounds inflicted by the enemy in a comparatively short time and reestablished completely (by 1946) pre-war scale of output in the majority of the principal branches of varietal production.

The principal task until the end of the fourth five-year plan, to which is subordinated varietal work, is to ensure the entire USSR of sugar beet plantings with pure seeds and more improved varieties of sugar beets. The prerequisites for this task are already at hand. Accomplishments in selection in 1946 are adequate for obtaining pure industrial seeds. Nevertheless, much has still to be done to improve varieties in the future.

Success in accomplishing the task depends to a large extent upon the accuracy of main prerequisites upon which future varietal work is based. These are:

1. Organism and external environment are continuous in their correlation(?). External environment viewed in wide concept (climate, soil, level of technique, methods of caring for plants, etc.) affects to a certain degree the transformation of properties of the organism, population, the course of complicated processes in natural selection, the efficacy of artificial selection. In this connection varietal work should aim at keeping the selection process on an

agricultural level that includes crop rotation, fertilization, height of yield and would be Typical for advanced farms at the time new varieties are introduced to industry. Thus agricultural technique at advanced farms must already reflect the superior background in subsequent five-year plans.

2. Selective processes will be more effective if not conducted on poor, narrow-generic initial material but on richer, more diverse, initial stocks. In sugar beet selection hybridization should therefore be used on a vast scale, specifically in combination with directed selection. Hybridization disconnected from systematic selection ("chaotic"), without rational regulating in pollination may produce average material, specifically loss in regional adaptation of sugar beets, i.e. loss of the positive results in ecological selection. Particular attention should also be paid to intra-varietal crossings in sugar beets.

3. Selection and seed growing must be inseparable. Propagation of seeds must go alongside selection and contribute to systematic improvement of the variety. In seed growing intra-varietal crossings of the components of varieties trained under different environmental conditions must be widely used.

4. Along with this must go on universal biological study of anatomy, biochemistry, physiology of sugar beets, genetics and cytology.

This is essential not only from the standpoint of stimulating increases in sugar contents and the yields of sugar beets but for speeding ripening, developing drought-resistance and resistance to diseases, improv^{ing} quality, aiming ultimately at increasing sugar output per unit area. Better knowledge of sugar beet crops will in turn contribute to further improvement in selection methods and seed growing.

L.A.B.
9-11-51

All-Union Scientific-Research Institute
of Sugar Beets (VHIS)

Sigrianskii, A. M., ed.

Transl. 202: Plant Protection

Spravochnik agronoma po bor'be a bolezniami sel'skokhoziaistvennykh rastenii
 [Agronomist's manual on control of diseases of agricultural plants]. Moscow,
 1936. 615 p. 464 Si2

Translated in part by Anna Antik

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L.A.P.

Sept. 12, 1951

Chanishvili, Sh. P.

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Utilization of roots from the summer [sugar] beet crop for transplanting.

Selek. i Sezen. 17(7):68-70. July 1950. 61.9 Se5

SR-44

Translated from the Russian by R. G. Dembo

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The experiments which we carried out upon irrigated fields of Gardabansk steppes with the stubble plants of sugar beets indicate that the introduction of this measure on the fields of collective farms of Eastern Georgia will considerably increase the base for raw material of our sugar industry, since one hectare of stubble sugar beet yields at the average up to 250-300 centners of roots.

Note: Sh. Chanishvili and V. Marsanova - Effect of summer sowing of sugar beets in Gardabansk raion. Informations of the Academy of Sciences of Georgian SSR, v. VIII, No. 3, 1947.

Sh. P. Chanishvili - Sugar beets and potatoes as stubble plants. Topics of report at the Third scientific session of the Institute of field production of the Academy of Sciences of Georgian SSR, 1948.

Besides, the roots of the sugar beets yield from the stubble field could be easily utilized as transplanted plants. According to the results of experiments, although of one year, which we described below, the tubers of sugar beets crops of stubble field are preserved better and less affected by "kagat" rot than the tubers of the harvest of regular spring sowings.

It is well known, that the conditions of Agricultural technics and of fertilization, especially boric, influence the ability of preservation and promote the improvement of the quality of tubers which are used for mother sugar beets.

Note: K. I. Litvin. - The influence of fertilization upon preservation of sugar beets. "Sugar beet field production", No. 3, 1938.

O. K. Ledrov-Zikhman, O. E. Kedrova-Zikhman, A. N. Kozhevnikov - The Effect of boron upon crops and the quality of the seeds. "Soviet Agronomy", No. 3, 1946.

D. Kalaida. - Preservation of mother sugar beet. "Soviet Agronomy". No. 2, 1948.

Prof. F. A. Rubin - Soviet biochemistry in controlling losses during the preservation of vegetables. "Soviet Science", No. 8, 1940.

This corresponds to the teachings of Michurin and Lysenko on the transformation of the hereditary ability of plants under the influence of the conditions of the environment. The more negative is the complex of the environment under which the growth and the development of plants occurs, the stronger is the transformation of the planting and seed material to the worst. This has been proved especially conspicuously by the academic T. I. Lysenko in determining the causes of the degeneration of potatoes from spring planting in Southern raions of USSR.

Sugar beets, as well as potatoes, are depressed in Southern raions of USSR in July-August from extremely high temperature and low relative air humidity which is expressed in more or less growth checking.

Based upon the study made by acad. T. I. Lysenko, we may assume that the roots of sugar beets of spring sowing whose rosettes with its buds are influenced by high summer temperature should possess worse characteristics in the mother sugar beet than the roots of the summer stubble sowings which are not influenced by these factors.

Based upon this assumption we started an experiment in 1946 at the Institute of field production of the Academy of Sciences of Georgian SSR for surveying for the mother sugar beet roots which were selected from the spring and summer sowings of 1948 which grew under similar soil conditions.

For planting were selected tubers of similar weight - at the average of 400 g. The tubers both of the spring and of the stubble yield were kept under similar conditions: in basement, in stacks, covered with sand.

Despite the fact that during the harvest of 1948 the sugar beet tubers of both the spring and the summer sowing contained approximately an equal percentage of water (about 83) in spring, on March 17, 1949, the tubers of stubble sugar beets contained 78.07 percent water, and the spring - only 73.73 percent. There was still a greater difference between them before the planting on March 23rd; there was in the roots of stubble sugar beets 75.3 percent water, and in the spring sugar beets only 69.3 percent. The tubers of the stubble sugar beets lost altogether 7.7 percent water during conservation, and the spring sugar beets lost 13.1 percent. In connection with this the percentage of loss of sugar in the stubble beets should be less than in the spring ones.*

*See the works of L. Kalaida and Prof. E. A. Rubin which were mentioned in the previous note.

We must also add that the percentage of waste from mound rot amounted to 68.3 percent in the tubers of the spring sowing, and in the harvest of stubble sugar beets there was only 20.2 percent of partly damaged tubers. The better storage of the stubble sugar beets in comparison with the roots of the spring sowing could be explained, apparently, by the difference in the stage of their growth during harvesting: the tubers of the stubble sugar beets are of a younger age than the sugar beet crops of the spring sowing.

The sugar beets were carefully selected, and the sound undamaged tubers were utilized for field and vegetative experiments according to the scheme: 1) planting of tubers of stubble crops and 2) planting of tubers of the spring crops.

In the field experiment the general field was 35.64 m^2 , the registered field - 23.76 m^2 ; it has been repeated four times. The quality of the sugar

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beets in both variations - "Verkhniachka" 10-25. The tubers are planted on ploughland on March 23 with between rows of 90 cm; 60 cm. were left between the plants in a row.

The mother sugar beet has been hoed twice: May 14th and June 15th; it has been watered four times: April 27, May 18, June 6th, July 3rd. It has been harvested on July 30th.

The observations made upon the experimental field indicated a considerable advantage of the plants of the stubble sugar beets in comparison with those of the spring sowing. The advantage was manifested in the following: 1) in a more quick formation of rosettes, 2) in a smaller percentage of the "stubborn" ones which did not form rosettes, or of rotten tubers, 3) in a considerable superiority of both the seed yield from each field and of the productivity of one plant, 4) in the improvement of the seed quality - a higher weight (see tables 1,2,3).

Table 1

The Course in the Development of Plantings

Development Phase	Planting of Stubble sugar beets	Planting of spring sugar beets
The initial formation of rosettes	1/IV	29/IV
Mass formation of rosettes	8/IV	--
The initiation of sprouting	16/V	28/V
Mass sprouting	19/V	--
Initiation in blooming	30/V	8/VI
Mass blooming	3/VI	--

Footnote: For root planting from the harvest of sugar beets of spring sowing are mentioned only the dates of the initial phases since only 55.7 percent of the roots formed rosettes, so that there was no mass initiation of observed phases.

Table 2

Percentage of plants which formed rosettes on May 18th

Type of experiment	percentage of plants which formed rosettes	According to the quantity of plantings	In relation to the plants which formed rosettes
Planting of stubble sugar beets	89.8	84.1	93.7
Planting of sugar beets of spring sowing	55.7	29.5	53.1

Table 3

Type of experiment	No. of planted tubers	No. of plants which formed rosettes	Percentage in relation to planting	No. of plants sprout- ing	Percentage to those which formed rosettes	Yield of seeds (in weight of centenars tubers per hec- tar)	Absolute Yield of 1 plant (in g)
Planting of stubble sugar beets	44	38	86.4	35.5	93.4	28.03	188
Planting of spring sugar beets	44	20.7	47.1	14.5	70.0	7.62	125

Footnote: The difference between the amount of the tubers which formed the rosette and the amount of the plants which started to sprout is explained by the fact that some number of plants with the rosette would wilt later due to various reasons.

It is evident that the plantings of spring sugar beets were behind, according to the growth of the stubble beets; the formation of rosettes spread during five weeks. While on May 18th in the plantings from the yield of sugar beets of spring sowing, in four repetitions, only 55.7 percent of tubers which formed rosettes were counted at the average, there were 89.8 percent from the stubble sugar beets. (see table 2).

During the vegetation of the mother sugar beet strong winds negatively influenced the growth and the development of the plants. On April 12 the Rosettes of young leaflets of the plantings suffered from a strong, North-eastern wind which cut the leaves by the ground particles. As a result, the leaves dried out almost completely, and later new leaves had formed.

Later on, strong winds caused lodging of plants which were strongly developed and the loss of some parts of the tubers. Despite of that, the mother sugar beet yielded quite high seed crops (see table 3).

The data given in table 3 indicate that the plantings from the crops of stubble sugar beets yielded almost four times as many seeds as the plantings of the tubers of the spring sowing. This is explained not only by the larger percentage of the plants which formed rosettes and which broke out into blossom, but by the high yield of individual plant as well. One plant from the stubble sugar beet yielded 188 g. seeds, and in the plantings of spring sugar beets there were only 125 g. Besides, the absolute weight of seeds in the first case is somewhat higher than in the second case.

The results of the vegetative experiment gave a similar picture, although the difference in the yield between the plantings of the stubble and the spring sowing is smaller than in the field experiment., which is quite clear, since during the vegetative experiment the conditions of growth (moisture, nutrition regime etc.) of the plants even up considerably (see table 4).

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Table 4

Types	Formation of rosettes	Sprouting	Mass blooming	Mass maturing	Yield (in c) for e vessel	Absolute weight of seeds (in grams)
Plantings of stubble sugar beets	21/III	9/V	30/V	5/VI	16.23	17.50
Plantings of spring sugar beets	8/IV	15/V	4/VI	10/VI	16.38	17.72

Table 4 indicates that root plantings from the stubble yield of sugar beets sprout and develop much faster than the plantings from the spring sowing. The reason is that at the time of planting the tubers of stubble sugar beets had a much higher percentage of moisture than the roots from the crops of spring sowing. By the way, the surveys made by I. A. Rubin and by other Soviet scientists indicate that the decrease of the amount of water in the cell protoplasms, due to wilting, "causes a drastic increase in hydriodic activity fermentations both of carbohydrate and of nitrogen compounds, i.e. the increase in the activity of the factors of disintegration."

Conclusion

1. The tubers of the yield from stubble sugar beets utilized for planting are considerably superior in their quality than the tubers harvested from spring sowing.

2. The tubers of the yield of stubble sugar beets during storage are rarely damaged by "kagat" rot, while the tubers from the spring sowing are damaged considerably. Besides, the first lose less water and plastic substances than the second ones.

3. The percentage of plants which don't form rosettes in the stubble sugar beets is considerably smaller than in plantings from spring sowing.

4. According to seeds from a field unit and according to the productivity of one plant, the tubers from stubble sugar beets are considerably higher than the tubers from spring sugar beets.

L.A.B.

September 13, 1951

(Has been presented by Academic I. V. Yakushkin)
Translated by R. G. Pembo

All forms of cultivated and wild sugar beets of the variety Beta vulgaris L., as a rule, have multi-seeded balls. There are no varieties of sugar beets (sugar or foddering etc.) which are characterized by one seed tubers.

The multi-seediness of the sugar beet tuber hampers the mechanization of sprouting because from each tuber appear 3-4 or more sprouts which are difficult to separate from each other. The multi-seediness of the tuber increases the amount of small plant sprouts, and consequently of the tubers as well.

In America attempts were made already in 1903 of producing one-seeded varieties. But this work was not successful and has been abandoned. All the attempts made abroad in producing one-seeded sugar beet variety were directed towards the sorting of seeds, according to the number of blossoms, instead of producing new one-seeded biotypes of sugar beets.

The selection work in USSR on the production of one-seeded varieties of sugar beets began in selection stations Main-Sugar. In 1934 huge massives of sugar beets plants were inspected and among them were discovered individual plants, all of which or the greater part of the tubers were one-seeded. The seeds collected from these plants were the basic material for our work. These seeds were natural hybrids between one- and multi-seeded sugar beets. All the transplanted seeded plants, as well as from pair crossings in isolators had multi-seeded tubers only with more or less great quantity of one-seeded fruits. Entirely one-seeded plants among the variety F_1 were not disclosed. According to their development (blossoming time) F_1 plants did not differ from the regular multi-seed sugar beets.

The one-seediness under regular conditions of sugar beet sprouting is recessive.

In F₂ there is a division between one- and multi-seeded fruits. In F₂ the majority of the plants which are mainly one-seeded, differ considerably according to their appearance from the multi-seeded plants, being characterized by a strong vegetative development and peculiar form of the bush.

According to various hybrids, the amount of the ^Psplitting one-seed plants fluctuates from 20 to 30 percent, including one-seed variety which don't blossom during the first year of life.

Along with the splitting, according to the number of blossoms in a tuber of F₂ hybrids with one-seeded sugar beets, a sharp division occurs according to the blossom time, whereby the chief characteristic is their early ripening. The plants of a later group are in their majority one-seeded.

One-seeded plants are characterized by late ripening of the plantings, but vary in the blossom time. The latest forms of one-seeded plants appear to be "upriamtsy" (stubborn) during the second year of their life. The number of "upriamtsy" among some numbers of hybrids is very great with one-seeded sugar beet. By artificially lengthening the vegetative period (in a nursery) these "upriamtsy" bloom and produce one-sprout seeds. The one-seeded plants are long stage forms.

Along with late maturing one-seed forms in F₂, a small number of one-seed plants differentiate which, according to the blooming time, don't differ from the regular multi-seed plants. Usually the same hybrids F₂ produce a small percentage of plants with many seed fruits. One-seeded plants which bloom simultaneously with many seed sugar beets yield normal crops and well germinated seeds (table 1).

Table 1

15--30/V.....	---	--	-	-	-	-	-	-	-	-	-	-	-	-
1-15/VI.....	---	--	-	-	-	-	2	-	-	-	-	-	-	1
15--30/VI.....	---	11	4	13	101	331	65	64	38	22	2	4	4	649
1--15/VII...	---	89	1	1	41	150	30	21	3	11	-	2	-	349
15--30/VIII..	---	49	-	-	1	2	2	1	1	-	2	-	-	58
1--15/VIII..	---	17	-	-	-	1	-	-	-	-	-	-	-	18
15--30/VIII..	---	1	-	-	-	-	-	-	-	-	-	-	-	1
"Kholostiaki"	100	--	-	-	-	-	-	-	-	-	-	-	-	100
"Upriamtsy"..	39	--	-	-	-	-	-	-	-	-	-	-	-	39
	139	167	5	14	143	484	97	87	32	33	4	6	4	1215

The posterity of one-seed plants selected in the second generation, obtained by group and pair crossing, appear to be one-seeded. The characteristic of one-seediness is preserved by crossing one-seed plants of various origin which enables to avoid the close crossing when producing one-seeded variety of sugar beets.

While the number of blossoms in the tuber with regular one-seed plants varies, by decreasing the number of plants under poor conditions of sprouting, one-seed plants are characterized by high resistance according to the number of blossoms in the tuber. We were unable to change the number of blossoms in one-seed plants in the nursery at entirely different planting and nutrition time.

Thus, we obtained straight lines according to ~~early ripening, one-seed~~ one-seediness. By selecting the plants according to early ripening, we obtained one-seed sugar beet varieties which are blooming at regular time. We carry on further work with these varieties in order to obtain constant lines according to the early seed ripening.

The study of hybrids F_3 according to their one-seed forms present an interest, according to their low blossoming.

The study of seed weight of one-sprout plants indicate that the seed weight which shells from the tubers of one-seed plants surpasses considerably the seed weight of the multi-seed tubers. (Table 2.)

Table 2

The Average Seed Weight in One Sprout and Multi Sprout Forms of Sugar Beets

Plants	Multi-seed			One-seed	
	one-sprout	bi-sprout	three-sprout	early ripening, 1 sprout	late ripening; 1 sprout
Seed weight (in mg)	1,8	2,6	2,7	3,7	3,8

It is interesting to notice that the seed weight of late ripening of one-seed varieties is not inferior, but on the contrary somehow higher than the weight of the seed of one-seed early ripened plants.

Presented April 8, 1941

The All-Union Sugar Institute.,
Kiev, Laboratory of Genetics

L.A.F.
Sept. 12, 1951

Sokolov, A. D., comp. Transl. 205: Plant Protection
 Sbornik postanovlenii, pravil i instruktsii po karantinu sel'skokhoziaistvennykh
 rastenii. (Collection of rules, regulations and instructions for the quaran-
 tine of agricultural plants). Leningrad, 1934. 84 p. 464.5 So3

Translated in part by R. Dembo

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Transl. 206: Sugar Beets

Conditions contributing to the propagation of the sugar beet flea (Poeciloscetytus cognatus Fieb.) and smaller fleas (Chaetoonema Breviuscula Fald. u Phyllotreta vittula Fedt.) and improvement of methods for their control. Vsesoiuz. Nauch. Issled. Inst. Sveklov. Polevod. Nauch. Otechet 1941-1942: 102-115. 1945. 66.9 V963.

SB-8

Translated from the Russian by S.N. Monson

The sugar beet flea (?) belongs to the most dangerous sugar beet pests. It prevails in all sugar beet areas but causes particular injury in the Altai krai where it destroys or severely injures annually a considerable part of sugar beet fields, necessitating repeated plantings.

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Existing control measures against these pests, both large and small, did not produce the necessary results, which caused VNIIEP to include the biology of these pests and methods for controlling them into the research program of the laboratory of entomology. The present article is designed to give a brief description of that work as conducted in 1941 and 1942.

Studies were engaged in under the supervision of Prof. P. A. Sviridenko; K. K. Predit, A. A. Gerasimova and G. D. Annenkov participated actively in the work.

Field tests and observations were organized at Altai krai, Rubtsov experiment field, and at the collective farms, imeni Kirova and Voskova, of Rubtsov region.

The development of sugar beet fleas (?) and their quantities were observed at station plots, which included all principal varieties of soils.

Various species of plants were examined to determine the wintering abodes of pests in early spring and fall periods; soil and vegetative layers were analyzed.

Simultaneously with determining the phenology of pests, actual calendar periods for applying destructive control measures under industrial conditions

at collective farms were studied and compared. The action of various insecticides was observed at laboratories and under field conditions. The assembled material permitted the determination of several important points in the ecology of pests and to plan measures for the protection of sugar beet plantings even before the completion of the project.

Conditions under which the Sugar Beet Flea Propagates

Three species of injurious fleas attack sugar beet plantings in the region under study. They are: the grey flea (Poeciloscyeptus cognatus Fieb.), vegetable flea (P. vulneratus Paus.) and the green flea (Orthotylus flavoparsus Shlb.).

The most widely spread and dangerous was the grey flea. This species injures, (in addition to sugar beets) also Compositae, oilbearing plants, perennial legumes and several bast crops.

The grey sugar beet flea lays its eggs upon many uncultivated and cultivated plants which serve as food for its larvae.

In the Pu tsov region of Altai krai the biological connection of this pest with 26 species of plants was established (egg-laying, feeding of adult insects and their larvae), primarily among the families: Chenopodiaceae, Cruciferae, Papilionaceae and Compositae.

Larvae were found to feed on only 19 species, and egg-laying was observed on the following 13 species: hedge mustard [Sisymbrium], rape [Brassica napus], field mustard, alfalfa, common wormwood [Artemisia absinthium]; Artemisia Sivers, bindweed [Convolvulus]; potatoes; sugar beets; saltwort [Salsola collina]; knot weed [Polygonum aviculare]; orache [Atriplex lacinatedum]; and pigweed [Chenopodium album]. The sugar beet flea develops and feeds to all appearances on several other plant species as well.

It shows, however, a definite selective capacity for some plants; thus pigweed, saltwort, alfalfa, rape, common wormwood were particularly infested by eggs of the flea. The pest developed more rapidly on pigweed than on the rest. In the winter of 1942-1943 eggs were distributed among plants in the following degrees: pigweed - 22 percent; saltwort - 8.7 percent; alfalfa - 4.6 percent, bindweed - 1.5 percent; common wormwood - 1.5 percent.

Principal sources during the spring infestation of sugar beet plantings boundaries are ~~xxxxx~~ of roads and irrigation canals, ~~boundaries~~, and other plots where pigweed and saltwort predominate. From these sections winged pests fly over to sugar beet fields. Following their settlement, the density of the flea population in its diverse stages becomes somewhat leveled.

Data on quantities of pests and observations on their development under natural conditions during the vegetation period reveal that propagation of this pest in the summer ~~will~~ takes place not on sugar beets but on road boundaries and irrigation canals, covered by various species of weeds, chiefly pigweed and saltwort.

The grey sugar beet flea severely populates alfalfa; on other crops and fields carrying stubble of wheat, rye, etc., the pest appears only when these are covered with weeds, especially pigweed.

Quantities of the grey sugar beet flea vary considerably throughout the different seasons and years. In 1941 they were enormous; in 1942 the density of population decreased drastically. According to surveys, density of population in 1941, in the different stages of development, varied from 0 to 2.960 specimens per 50 strokes of "sachok"; while in 1942 it amounted to a proportion of 0 to 785 specimens.

The number of pests fell in 1942 because of weather conditions (lower temperature of air and increased humidity) and in connection with the mass propagation of the parasite-"naesdnik" which destroyed all larvae of pests. Destruction of pest larvae by larvae of the parasite amounted to 70 percent in the summer of 1942.

The cycle of development of sugar beet fleas at Altai krai lasts 25 to 35 days. During the summer the pest may produce three to four generations; the latter are, however, extended and overlap, which makes it difficult to recognize them under natural conditions. Fertility of females depends upon the type of plants they feed on. In feeding upon pigweed, saltwort, hedge mustard, females lay a larger number of eggs than when feeding on other plants.

In the summer females lay eggs chiefly on lower and upper surfaces of leaves of sugar beets, mustard plants, etc., in the fall on stems of pigweed, goosefoot, saltwort, bindweed, wormwood, rape, and hedge mustard.

The pest lays eggs from two to six times. According to counts made in the fall of 1942, the quantity of egg egg-laying varied; 1st laying produced 18 to 20 eggs; second laying - 14-16 eggs; 3rd laying - 10-12 eggs; 4th laying - 6-8 eggs; 5th laying - 2-4 eggs; 6th laying - 1-2 eggs.

The eggs of the flea are highly resistant to frost. Dry and warm spring weather offers the most favorable conditions for the development of the first generation. The rapid development and good survival of larvae of the first generation usually is followed by mass flights of the pest to sugar beet fields and their subsequent injury. At Altai krai spring has limited precipitation. Plants upon which larvae of the first generation feed are

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hardened by the time the pest is win^{ed}; this prompts the pest to migrate upon young plants, the sugar beet sprouts.

Large areas of waste land and other soils covered by vegetation and favored by the pest, as well as spring weather contributing to the development of larvae, are the main reasons for repeated mass appearances of the sugar beet flea.

The adult flea of the first generation is most harmful to sugar beet plantings. Here is where control is most essential.

Mass appearances of the sugar beet flea are determined by the migration of this pest from its wintering abodes (place of all egg laying and development of larvae of the first spring generation). Of decisive importance is consequently the control of initial infestation of sugar beet plantings: destruction of wintering eggs and later of their larvae.

Sizes of land plots on which fleas lay their eggs in the fall and on which they feed and develop larvae in the spring are, on the whole, considerably smaller than plots of subsequent infestation by adult fleas of the first generation and the latter's future progeny. It is therefore expedient to organize pest control at initial sources of infestation to protect sugar beet plantings and conserve poisons and material; to effect this weeds should be burned in late fall, plots plowed over, and in the spring insecticides used against larvae.

Test of Pyrethrum and Bileous Preparation in the Control of the Pest

Preparations of pyrethrum and bile solutions taken from cattle (refuse obtained from stockyards) are tested under laboratory conditions as a means of controlling sugar beet fleas. As a result of tests of different dosages

of pyrethrum, it was found that mortality of larvae of fleas was high as a result of use of liquid extracts of preparations of 0.006 percent concentration.

It was subsequently established that under identical conditions alcohol extract of pyrethrum produced a higher mortality (91.4 percent) than extracts prepared on transformation? oil (76.2 percent). A study of bile of cattle revealed its insecticidal properties. It was found that bile exerted a high contact toxic action upon the sugar beet flea. By spraying pests with 1 percent solution of bile an average mortality of 52 percent was achieved. By applying weaker solutions mortality was lower, but still high; 0.5 percent solution destroyed 50.4 percent of specimens; and a solution of 0.25 percent - 39.6 percent.

Along with high contact-toxic properties, bile spreads well on foliage and body surfaces of pests. This property is very valuable, since the efficacy of various insecticides used in pest control depends to a large extent upon good regular spreads by the liquid.

The addition of bile to liquid solutions of insecticides must increase the efficacy of not alone contact poisons, used in pest control, but also poisons of internal action. During complete coverage of foliage with poisonous solution, the plant is better protected and less affected by insects. In attacking plants the latter are swallowing deadly dosages of poison more rapidly from a smaller area of injured leaves.

The addition of bile to a liquid solution of pyrethrum greatly increased the toxic action of the solution in our tests.

The highest mortality of larvae was obtained from an application of 0.006 percent solution of alcoholic extract of pyrethrum (1:1) and 0.25 percent liquid of bile solution. In spraying weed vegetation (pigweed and

saltwort) upon which larvae of fleas had settled, the average mortality was 94.5 percent.

The temperature of the surrounding environment had considerable effect on larvae treated with pyrethrum; important is also the leaf structure of sprayed plants. At a temperature below 17-18°, toxicity of liquid Pyrethrum is somewhat reduced. Mortality of larvae on pigweed leaves is lower (when sprayed) than on saltwort.

We also tested the effect of powderlike Pyrethrum which exhibited a high toxicity with regard to larvae of sugar beet fleas. In many laboratory experiments mortality of fleas varied from 7.8 to 34.6 percent. Dusting various weeds in the fields (air temperature 22°) resulted in a mortality of larvae of 99 percent.

Thus Pyrethrum in liquid solutions and powder is a completely reliable method for destroying larvae of the grey sugar beet flea. The addition of bile ^{aids} ~~increases~~ the spread of the liquid on the plant and body of pests, the contact of poison with the delicate bodies of larvae, and in addition, because of its own contact activity, toxic properties of the combined insecticide are significantly increased.

Conditions for Propagating Sugar beet and Striped Fleas of

By regular observation and control/all stages we established 11 species of small fleas ("bloshek"); of these only three species are dangerous to sugar beets: the common sugar beet flea [Chaetoonema concinna Marsh]; the southern sugar beet flea [Ch. breviuscula Fald.] and the striped grain flea [Phyllotreta vittula Redt.].

There are numerous references in literature indicating that the small striped flea is less dangerous to sugar beets and that this species represents only an insignificant specimen among the mass of sugar beet small fleas.

Our observations further established that the striped small flea is a most harmful sugar beet pest and apparently chiefly responsible for the vast injuries caused to sugar beets in their early stages of development, repeatedly observed in Altai krai.

The harmful activity of the striped small flea is of the same nature as that of the large sugar beet flea, although the striped pest attacks sugar beet plantings earlier than do common and southern sugar beet fleas.

In 1942 the striped small flea attacked sugar beet plantings in early June, at the time^{when} there were no sugar beet fleas. The latter began to settle upon sugar beet fields only in the third week of June.

Observation stations of the Record Service, in establishing their prognoses of past appearances, drew attention only to sugar beet fleas, as a result of which the danger threatening sugar beets was always minimized. In addition, measures for the control of fleas on sugar beet plantings were usually adapted to the period of activity of sugar beet fleas, while striped specimens made their appearance much earlier.

Estimates of pests wintering in 1941 - 1942 revealed that the largest number of sugar beet fleas was distributed along boundaries of irrigation canals ("aryki") overgrown with grass. Here the density of small fleas was largest; then came plots along boundaries of old sugar beet fields, overgrown with weeds; the old sugar beet fields themselves, and barren lands, as well as road boundaries. On other land quantities of sugar beet fleas were small.

Wintering striped fleas had a different distribution in 1941. While density along irrigation canals was enormous, a large amount of pests was also concentrated on winter wheat plantings. Thus the principal location for wintering and the foci of mass settlement of sugar beet- and striped

fleas at Altai krai are primarily at boundaries of irrigation canals overgrown with grass. The sugar beet flea winters in vast numbers on old sugar beet fields and surrounding weeds, road boundaries, irrigation canals and on empty plots, while the striped pest prefers plantings of grain crops.

In early spring the striped flea migrates after wintering to sugar beet fields where its number increases rapidly. Later this species settles among other plants and their quantities are therefore not increased on sugar beet fields during the summer, as are the quantities of sugar beet small fleas which in masses appear somewhat later and reach their peak when the new summer generation appears. In addition to settling on plantings of sugar beets, the sugar beet small flea attacks plots overgrown with weeds, especially pigweed, saltwort, hedge mustard.

The quantity of fleas in different stages varies depending upon seasons, and is determined by their propagation and migration. In the second half of summer the number of sugar beet fleas is reduced on best fields and increases on edges of irrigation canals and empty lands, overgrown by weeds, primarily by pigweed, saltwort and hedge mustard.

Concentrations of small fleas are observed first along edges of canals situated near sugar beet fields, where their number is large. In June the population decreases when pests migrate to sugar beet fields. Beginning August, irrigation canals again attract pests as wintering hideouts and their number increases there.

In order to prevent mass appearances of small fleas on sugar beets, pests should be exterminated on fields in the spring, as is usually done, and on their wintering abodes in the winter and early spring.

Settlement of pests during the winter and their quantities throughout the vegetation period point clearly to the necessity of burning weeds around

plantings of sugar beets and the eradication of weeds in time.

Edges of irrigation canals are particularly apt to become overgrown with weeds, along with boundaries of roads, waste lands and rows where agricultural machinery passes. Weed vegetation in these places serves as food ^{and wintering hideouts} for pests throughout the entire vegetation period. ~~and as wintering hideouts~~

Experience has shown that burning of weeds in the spring destroys 2/3 of the pests. Burning of weeds in late fall when the dry grass burns particularly well, is even more effective.

Mass injury caused to sugar beets by small fleas, in the past years at Altai krai, is the result of not only inadequately conducted cultural, mechanical and chemical control methods, but also of the low efficacy of the measures themselves, which to a large extent is due to lack of coordination and poor correlation of control measures with periods of appearances of pests of the first generation from their winter hideouts and flights of adult pests of the second generation, as well as the inadequate attention paid to foci of pest accumulation.

Infestation of small Fleas by Parasites

In 1942 a high degree of infestation of small fleas by internal parasites, the larvae of "naezdnik" of the family Fraconidae was noted. Striped small fleas were infested by these parasites in small measure (2 percent) and only in June. Infestation of sugar beet fleas, however, gradually increased and in September amounted to 15-30 per cent. Fleas infested by larvae of this parasite perished as soon as the larvae of the parasite made their appearance. Laboratory observations of the parasites established the possibility of their propagation.

In addition to the parasite-"naezdnik", pests were infested by nematodes.

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Vegetative Poisons in the Control of Small Fleas

Injuries caused to sugar beets by small fleas in the earliest stages of plant growth cause greatest harm. Pests feed then on the pulp of cotyledons and first leaves, frequently injuring ~~the~~ growth points. Insecticides of intestinal fluorides and arsenic preparations and contact-nerve-muscular action (nicotine, pyrethrine and anabasine preparations) are applied in post control. At the time of initial plant growth the foliage surface of beets is so small that spraying and dusting poisons are penetrating the soil more than anything else, without any benefit to the plants. Only a small amount affects the rows of plants in places where injuries are caused by pests. This interferes with pest control and frequently obstructs the effort.

In early spring, during the formation of sugar beet plants, fleas are attracted to plantings not only because these represent forage to them, but because of microclimatic conditions prevail on plowed fields. At that time the plowed black soil layer absorbs more sun than do adjoining places covered by grass under which pests over-wintered. The difference in temperature between the surface of black fields and adjoining boundaries of roads and irrigation canals causes the pests to migrate to sugar beet plantations even when there is no adequate food there. When temperature of the air drops in the evening and on windy days fleas look for cover under clumps of earth or in dense rows of planted sugar beets on which they feed.

This micro-climatic factor in the earlier migrating of fleas upon sugar beet fields and the limited forage resources on plantations during early periods of the season were responsible for the development of the attractant method of control. Green weed grasses were used as attractants, especially those most favored by pests, (hodge mustard, pennycress, rape, saltwort,

gold of pleasure [Camelina sativa], etc.), which were distributed on fields in small piles (220-300 g). They were chiefly placed in checkerboard fashion at a distance of about 2-2.5 m. from each other. The attractants were dusted with nicodust, pyrethrum or sprayed with nicotine-sulfate or liquid solutions of pyrethrum ~~preparation~~. The green attractants drew pests as forage and cover during cool weather; here fleas concentrated, were poisoned and destroyed. Destruction on attractants amounted to 86-90.7 percent. Attractants dusted with pyrethrum produced a higher mortality than those dusted with nicodust. Pyrethrum evaporates more slowly and attractants treated with this preparation drew more pests to them. It was also observed that the effect of Pyrethrum in piles of vegetative attractants lasted longer than on uncut vegetation.

The method of controlling small fleas with the aid of attractants represents a saving in expenditures of poisons and permits exercise of control at the earliest period of sugar beet growth. In addition, green attractants detract fleas from sugar beet fields, reducing the amount of injury.

In addition to vegetative attractants a mixed liquid preparation of pyrethrum (0.048 percent), bile (2 percent), and molasses (1 percent) was tested. This preparation results in a higher percentage of destruction (85.7 percent) than obtained by nicotine-sulfate (42.7 percent) and sodium fluoride (70 percent).

Bile in this preparation contributed to the formation of stable emulsions, while molasses improved the adhesion of the insecticide to insect surfaces and in addition attracted small fleas.

Conclusions

1. The principal source of spring infestation of sugar beet plantings by large and small fleas is their wintering hideout: edges and boundaries of roads and irrigation canals, waste lands, and other plots overgrown with weeds;

2. Sugar beets are injured most in early periods of growth when not hardened and lacking large foliage surface. Sap sucked from young plants by fleas, injury of cotyledons and growth points frequently caused complete destruction of plants.

The adult flea of the first generation is of greatest injury to sugar beets; it goes through its larvae stage on weeds and uncultivated plants in places of egg-laying in the fall. Sugar beet fleas are attracted in early spring to plantations not only by plant sprouts but chiefly by favorable micro-climatic conditions.

4. Control of both small and large fleas is usually exercised on sugar beet fields when plants are injured during noticeable concentrations of pests. For better plant protection and non-admission of mass migrations of pests from their wintering abodes, as well as to save poisons, control should be applied not on sugar beet fields but at the pests' initial accumulations, i. e. their wintering hideouts. This may be accomplished by burning weeds in the fall and applying chemicals and cultural treatment in the spring against larvae (overplowing of wintering places).

5. Bile of livestock obtained in large quantities from stockyards possesses high toxic properties as a contact insecticide. While toxic, bile is also a good emulgent which ensures, in combination with other insecticides, a good spread of poisons on ^{foliage} surfaces and bodies of insects. The addition

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of bile to solutions of insecticides increases the efficacy of their action upon insects.

6. The liquid preparation of Pyrethrum (0.048 percent), together with molasses (1 percent) and bile (2 percent), leads to a higher percentage of destruction among pests (85.7 percent) than did nicotine-sulfate (42.7 percent) and sodium fluoride (70 percent).

7. Green vegetative attractants (which attract fleas most among weeds), treated with nicodust, nicotine-sulfate or pyrethrum attract fleas as forage and cover during cool evening temperatures. Green attractants permit application of control during early stages of sugar beet growth when greatest injury is caused by pests, while spraying or dusting with chemicals of entire fields do not produce proper results. This method, upon being tested under industrial conditions, may be widely introduced into practice for the control of small fleas.

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SB-124

Translated from the Russian by S. N. Monson

Svekla (Beet [Beta vulgaris L.] is a biennial root plant of the goose-foot family (Chenopodiaceae). The uncultivated beet has a coarse branched root of small weight and usually insignificant sugar content (0.2 - 6 percent). It is found on the shores of the Mediterranean, Black and Caspian Seas, in Transcaucasia, Central Asia, the Canary Islands, and in California. An uncultivated beet was found in the mountains of Azerbaidjan (B. macrorhiza Stev.), a perennial root, weighing frequently to 10 kg., sugar content to 12-16 percent. From this wild sugar beet were obtained, following many years of selection, forms of cultivated forage and table beet varieties.

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Sugar Beet (B. Vulgaris Var. Saccharifera) was evidently produced from white varieties of garden table beets. It has a relatively large root (from 330-600 g. to 1,500-2000 g.) and contains 17 - 20 percent of cane sugar. Individual roots contain 24 percent of sugar; the industrial output represents 16 - 20 percent of the weight of processed sugar beets.

Normally only vegetative organs, i. e. foliage, roots and root bodies are formed from planted seeds ⁱⁿ the first year. In the second year flowerbearing stalks are formed from buds of planted root fruits which produce seeds towards the end of the summer. Under unfavorable weather conditions, i.e. spring frosts, (the latter affecting plants in their early stages and leading evidently to complete vernalization); isolated beets develop flowerbearing runners and flower ("tsve tukha") in the first year; the result is a coarse beet of little sugar content. This characteristic appears in many varieties in different degrees. Occasionally plants do not produce any stalks and seeds even in the second year.

Flowers are bi-sexual with 5 corolla-like perianths, 5 stamens and pistils; flowers are in groups of 2, 6, 10; ovary uni-nidular (?) ("odnognesdnoe") with one? cotyledon resting on a receptacle with which it unites in ripening. Fruit is nutlike. In ripening fruits aggregate forming clumps at their bases, so-called seed balls. Each fruit consists of remainders of the perianth and the seed, a shiny brown structure of white starchy content. It represents 50-55 percent of the total weight of the fruit body. The outer seed coat consists of the folded embryo; it surrounds the perisperm in the center in an incomplete ring ("albumen"). Two cotyledons are formed in the seed ball, the cotyledon "elbow" and the embryonic rootlet. The chemical composition of seeds changes depending upon variety and conditions of cultivation. Content of major substances varies within the following limits (in percent): water 9.5 to 10 percent; raw protein - 20.13-23.25 percent; raw fats - 16.88-23.10 percent; non-nitrous substances - 44-54 percent; cellular tissues - 1.69-4.54 percent; ashes - 3.74-4.42 percent; amount of phosphoric acid in ashes is ab. 45 percent. Nitrous substances consist of 65 percent albumen. Carbohydrates are represented primarily by starches (to 37 percent).

Normal growth of seeds produces no less than 150 seedlings per 100 bodies, of which no less than 75 should produce seedlings in turn. Large fruit bodies (not any smaller than 3-4 mm in diameter) produce large average weight roots and high yields, compared to small bodies. Seed sprouting begins at 4° and proceeds more rapidly at 25°. At first seeds swell, absorbing 150-170 percent of water compared to their weight. The sprouted seed first develops a rootlet, then cotyledons which turn green. Planted at average depth (2.5 cm), (in dry weather - 4 cm), into friable, normal, moist soil of 8 - 10°, seedstalks should appear on the 10th or 12th day. Following the appearance of real leaves, cotyledons die off.

The initial structure of beet roots differs from that of a mature plant. In the center are vessels, at the sides of which is the parenchyma with the initial cambium and fiber. Between the fiber and endoderm of the original cork there is another layer of cells - the pericambium. The mature beet has concentric rings or zones of vascular-fibrous bundles which do not resemble the original structure. The transfer from primary to secondary structure is very complex. An accelerated growth of the pericambium causes the root to develop in thickness; this takes place so fast that the initial cork tears and is shed. The root is closed by a second cork formed from the pericambium. In the secondary cork secondary cambial rings are formed which in turn produce vascular-fibrous bundles. After this process a new cambial ring is formed in the cork, at a certain distance from the first. This again forms vascular-fibrous bundles, etc. The spaces between rings of bundles are occupied by sugar-bearing parenchyma of which the cells continue to grow even after new rings have formed. At the crown leaves are distributed in spirals, young leaves occupying the center, old leaves on the periphery. Thus vascular-fibrous root bundles, which continue in leaves, must cross at the crown. The mature beet is composed of three regions: the upper part, i.e. the crown; the neck, which connects the crown with the lower and most important part of the plant--the root. The neck is formed from the cotyledon knee (bend) and does not have any leaves or side rootlets. Root or root body is cone-shaped, flattened on two sides and often grooved; two depressions form a spiral and contain lateral rootlets arranged in two double rows. The root system extends in the soil to a depth of 1.5 - 2 m. Important links in the root system are the short-lived haired rootlets (1-3 mm long, 0.08-0.14 mm thick). In addition to the characteristics of the root structure, external morphological

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characteristics of leaves and root bodies are important from an economic standpoint. In type of foliage plants are divided into groups: the so-called "lying" and "upright" close spiral foliage. Under conditions deficient in insulation, plants with "lying" foliage are more productive; they absorb sunrays in greater measure. Of similar significance is the intensity of leaf coloring and shape of leaf lamina, whether smooth or curly. Curly leaves and intense green coloring permit a plant to absorb more sun when insulation is inadequate.

Roots are elongated, cone-shaped, truncated (best yield, slightly lower sugar content) and cylindrical (medium sugar content). Aside from yield and sugar content other considerations are connected with the shape of beets; ease in digging, losses in harvesting because of tearing off of tip, etc. Root and leaf shapes are inherited characteristics and are important features in selection. Growth of foliage and roots during the vegetative period is irregular. Schematically, the course of sugar beet growth may be divided into three periods. In the first period the plant develops primarily its foliage, while root growth falls behind; during the second period the root body is at its most active. The development of leaves continues but the tempo is slower than that of roots. The third period of growth is characterized by a slowing down in both leaf and root growth--instead there is intense accumulation of sugar. Leaf growth is practically zero and gradually stops. In contrast, roots continue to gain weight well until late fall, although the speed is gradually reduced. Reduction in weight of foliage noted at the end of August does not indicate discontinuance of new growth. The latter continues throughout the vegetation period; having reached the stage of the tenth leaf, the plant produces a new leaf every day and a half. Beginning July leaf dying is more noted, and in the middle of August, the quantity and area of dead leaves

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exceed the amount of new foliage. The above characteristics in the process of leaf and root growth strongly influence the relationship with regard to weight in the first and second periods. In the beginning of the vegetation period root weight represents only $1/10$ - $1/6$ of weight of leaves, while during harvesting, it exceeds the weight of the foliage one and a half times.

The most important composite part of sugar beet, sucrose (or cane sugar), is formed from monosaccharides (?) synthesized foliage, transmitted to the root. Synthesis of cane sugar in the root at the expense of monosaccharides is accomplished by fermenting invertase.

The sugar content of roots is constantly increased during growth; the largest accumulation takes place in August. Increase in sugar content continues through September and October. Sugar content is irregular in various root parts. Among the above mentioned three parts, the root is richest in sugar content. In vertical direction, sugar content increases from the top of the root downward towards the bottom of the upper half of the root, which usually corresponds to its largest diameter. Then it diminishes, reaching its minimum at the tip of the root. Despite the reduced sugar content at the tops, it is, nevertheless, adequate to warrant their industrial processing. In cleaning beets of leaves during harvesting, the tops are therefore preserved on the roots and are equally processed. In a cross-cut, the area between the central ring of vascular-fibrous bundles is richest in sugar content. The latter is reduced as it reaches the periphery of the root, as well as its center. There are indications that sugar content is connected with the size of cells of parenchyma and that larger cells usually produce less sugar than smaller cells. The advantages of the beet root, however, as a raw material from which white crystallized sugar is obtained, are determined not

only by their sugar content. Of considerable importance for processing sugar beets and sugar production is the remaining part of dry-root substances called "non-sugars". The degree of use of sugar from the root depends upon the amount and quality of composition of non-sugars and the possibility of obtaining sugar in crystallized form. The higher the quality of non-sugars contained in the root, the lower its quality. The harmful action of non-sugars is the result of substances that belong to non-sugars and interfere with the crystallization of sucrose. For reasons of a physical-chemical nature, sucrose is retained in the solution, a part of it remaining in molasses. Among the most harmful non-sugar molasses-forming substances are the diluted forms of nitrous combinations, i.e. amino-acids, organic bases of salts of nitrous acids. Among ash-containing elements, potassium and sodium are of major significance in this connection.

A certain conception of the quality of sugar beet root is derived from the so-called "good quality" which refers to the percentage of sugar content in the dry substance. Thus 85 in "good quality" indicates that 85 percent of dry substances apply to sugar and 15 percent to non-sugar. At an equal degree of sugar content, the more superior the root, the better is its "good quality."

The transpiration coefficient(?) in sugar beet is not high (300-350), but because of the enormous evaporating surface, the total amount of water needed is very large. It is commonly believed that the normal development of a plant is taken care of by 300 mm of precipitation during the vegetation period. Of greater significance, however, is not the total amount of precipitation but its distribution throughout growth periods of beets. In the early stages of growth plants not having an extensive leaf surface have but

The best predecessors for beets are winter cereals, especially winter wheat, planted on clean fields fertilized with manure, and perennial leguminous grasses. Growing beets in continuous culture, even with ample manuring of the soil results in depressed yields and ^{loss of} sugar content. Under crop rotation beets favorably affect yields of other crops; they specifically serve as good predecessors for spring wheat.

Cultivation of the Soil should be thorough and deep; only in that case will roots develop normally and attain proper shape. The latter circumstance is of great significance from the point of view of yield and the possibility of light cultivation of beets. Deep plowing is engaged in in late summer or early fall. Stubble disking should precede it. The latter must be done immediately following passage of the combine and simultaneous removal of hay, and if ordinary machinery is used, prior to transportation of sheaves after they are distributed in piles. Depth of main plowing should be no less than 27 cm. with plow and foreplow. Fields plowed in the fall are not harrowed. In the spring when first driving into the fields, the soil is cultivated with scrapers or is harrowed twice with heavy equipment. Cultivating and harrowing before planting is done according to schedule and by methods suited to local conditions. If the soil, hardened because of flood and use cannot be made friable at proper depth, the soil is worked with shares without moldboards.

Fertilization of soils at sugar beet state and collective farms is decisive for increasing yields of beets and other crops under crop rotation. Beets carry away a much larger amount of nutritious elements from the soil than do other plants under crop rotation. Nutritious elements are absorbed by beets throughout the vegetative period, most of all during July and August. In recent years studies of domestic and foreign authorities have

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demonstrated conclusively the inadequacy of the ten "classic" elements of nutrients for sugar beets. It was established that absence of boron in the soil produces in beets rot of the "heart", (usually on soils of alkaline reaction), and that lack of manganese leads to leaf spot and leaf roll. Experiments made with magnesium phosphate showed that they benefit yields of beets more than super-phosphates. Of specific significance for beets is sodium. On leached and vigorous chernozem it noticeably discloses positive action. This accounts for the advantage of using potassium nitrate in place of calcium, and established that potassium and mixed salts (30 percent) are superior to concentrated potassium fertilizers. In estimating the norm of mineral fertilizers it should be borne in mind that the percentage of application in the first year is 15-30 for phosphoric acid, 30-50 for potassium acid and 60-80 for nitrogen.

Matching the characteristics of beet nutrients, fertilizers are introduced by three methods: 1. basic fertilizers (manure, minerals or their compounds) are introduced under deep plowing; 2. row fertilizing - parallel with the planting of seeds by combination planter; 3. additional feeding--in-between rows during hoeing, from the end of cultivation until the foliage grows dense between rows.

Beets develop slowly in early periods of growth and their root system is incapable of absorbing food elements from fertilizers introduced deeply during plowing into the soil; row fertilization is of significance, in this connection, consisting of super-phosphates, potassium salt and potassium nitrate, which is better for beet crops than do nitrogen fertilizers. Using ammonia salts on northern chernozem is not recommended because beets absorb

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them poorly when young, if the soil lacks alkali, while absorption of ammonium by mature plants is equal to that of nitrites. Depending upon variations in soils, row fertilization is introduced in the following tentative dosages (kg per hectare): N-10-15; P₂O₅- 20-30; K₂O - 10-20.

- It is expedient to substitute the usual technique of introducing row fertilizers (almost to the same depth as seeds and closely adjoining them) with the distribution of fertilizers along side seeds and below them. Beets develop better from the start when fertilized rather than without it; they develop resistance to diseases, pests and unfavorable weather conditions. Additional feeding with well diluted and accessible fertilizers of nitrogen, potassium and phosphorus, as well as liquid and bird manure increase beet growth considerably, improve retarded plots and eliminate former deficiencies in fertilizing. Additional feeding is given upon checking after thinning, at times even prior to the "joining" of rows. Norms of fertilizers in additional feeding and the very nature and intensity of this method change depending upon soil conditions, the course of meteorological indicators, previous fertilizing, and quantities of additional feedings, as well as age of plants and technique used. This measure need not be uniform. As an example one may refer to dosages of elements for additional feedings recommended by Glav-svekla of NKZ of USSR.

The increase of dosages of nitrogen and potassium in additional feedings should be applied on light grey and grey "opodzol" soils, next on leached and "opodzol" chernozem. On vigorous and ordinary chernozem it is expedient to increase the amount of phosphorus. Early additional feedings should contain nitrogen which contributes to leaf growth. Later introduction may injure root quality because of the increase of the content of non-albumen, of "Harmful" nitrogen. Late introduction of P₂O₅s, however, beneficial.

Dosages of Introduced Elements of Food under Beets in Additional Feedings

Additional feeding	Depth in cm.	Distance from row (in cm)	In kg/h		
			N	P ₂ O ₅	K ₂ O
First	10-12	10-12	10-12	15-30	15-30
Second	16 and deeper	22.5	10-20	15-30	15-30

Application of additional feeding of sugar beets in our country is the result of the spread of the Stakhanov movement, credit belonging to goals of "five hundred" and "thousand" records attained by laborers. In 1935 M. Demchenko and other women field workers of the "500" group, which attained these goals, began introducing this method for the first time at their farms and obtained good results. At present their example is followed by other collective farms. Additional feeding ~~should~~ despite its positive action should nevertheless, not replace basic fertilizing, since the latter still remains the decisive chemical method in beet growing. Norms and combinations of basic fertilizers depend upon yields, type of soil, predecessor, qualities of fertilizers and periods for their introduction. For manure the norm has been established at 18-40 t/h; for mineral fertilizers (in kg/h) at 60-120 N, at 60 - 180 P₂O₅ and from 60-200 K₂O. In combining manure and mineral fertilizers dosages of the latter are correspondingly decreased. The efficacy of fertilizers is closely connected with the quality of other agro-technical methods and is raised under improved agricultural standards. It has been established that on different soils the efficacy of nitrogen and potassium fertilizers increases in a measure corresponding to transfer from ordinary chernozems to vigorous chernozems, and from the latter to northern chernozems.

and grey forest-steppe soils. Additions of phosphorus are increased in reverse order, reaching their maximum on vigorous chernozems.

Aside from the increase in yields, all fertilizers, except nitrogen, increase (and this only when introduced in raised norms, without adequate quantities of phosphates and potassium) the sugar content in roots by 0.3-0.7 percent and even by 1.5-2.5 percent. Of particular importance is potassium for increasing sugar content.

Residue of beet industry and muck may be successfully utilized on many soils as lime fertilizers. Prior to liming soils of increased hydrolytic acidity, the super-phosphate may, when initially introduced, be replaced by phosphorite? flour? at double the amount of phosphoric acid.

The combination of organic and mineral fertilizers in initial introduction and additional feedings may radically improve the balance of carbonic acid in the aboveground layer of air. In high increases in yield (on record breaking plots) the daily increase at certain periods reached a colossal amount (30 c/h).

During periods of vigorous development beets may require CO_2 . In that case the amount of carbonic acid extracted from decayed organic fertilizers is particularly significant. Tests have shown that phosphoric acid and potassium of manure are more fully absorbed by beets than from corresponding mineral fertilizers, since phosphoric acid of manure, together with organic elements, is gradually mineralized and not subject to retrogression. Nitrogen from manure is absorbed by plants in much smaller degree than mineral nitrous fertilizers.

Planting of beets is done only with row planters. Nest planting has not become popular yet. Planting is usually by tractor-driven combination

with inter-rows of 445 mm. The average norm of planting is 30-32 kg/h. After planting rolling is essential to make moisture more accessible to seeds and even field surfaces. The latter aids in subsequent field work. Planting must be in straight regular rows, otherwise mechanical work in care and digging is impossible. The advantage of early plantings (together with row planting of cereals when the temperature of the soil is 5-6°) is indisputable. Too early planting is, nevertheless, worse than normal planting. To ensure high density of crops regular and close sprouts are essential.

Vernalization of seeds of beets, judging from experiments made in 1936-38, is of considerable industrial significance. By speeding the appearance of sprouts, vernalization aids energetic growth not only in the initial period of development, but also in subsequent months, a circumstance which reflects favorably upon ultimate yields. To prevent flowering, it is recommended to plant vernalized seeds when the temperature of the soil is 6-7°. Vernalization is done 10-12 days before planting. 100 kg. of seeds require moisture of
in four
14 percent ~~in~~ supplied/doses in the course of 48 hours, and 90 liters of water. On the 4-5 day there should be 3-5 percent of sprouting seeds. Later the temperature of seeds before planting is kept at 5-7°, achieved by regulating the thickness of seed layers. The number of sprouted seeds before planting should not exceed 10-15 percent. Aside from vernalization the practice of moistening seeds of beets has gained popularity in the past years at state and collective farms. This is done 4-5 days before planting, the proportion of water being equal to the weight of seeds. Water is added gradually, 4 or 5 times, as absorbed by seeds; the entire procedure should not take longer than 24 hours. On the 3rd and 4th day temperature of seeds reaches 18-25°, which contributes to their fast "awakening." Temperature

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hoe the soil, destroy weeds. After checking, as weeds continue to grow, corks form on the soil as a result of rains; hoeing between rows no less ~~less~~ than 3 cm. deep follows to the depth of ^{the} main parts of the plant. (12 cm. for UKS-1 and 16 cm. for VNIISP-SK). Deep cultivating between rows must take into consideration the condition of moisture and firmness of the soil and growth of beets. In periods of close stand of beets weeding must be done by hand. Additional feeding is successfully combined with cultivation between rows.

Special plant feeders have been constructed which permit the introduction of fertilizers to proper depth, (in solutions and dry state). Mechanical in-between-row cultivation is done by the tractors "Universal-2".

Harvesting is begun in the middle of September. The Party and Government have set definite periods for the end of digging, the completion of which must be strictly observed. Equally compulsory is delivery of beets to industrial plants immediately following digging. Delay of either is harmful to yield and increases losses.

In establishing the order in which beets are to be dug at different parts of fields the following must be considered. The first and second weeks in September produce an average of 2 c/h in additional growth of yield on roots and increase the sugar content by 0.1 percent. Digging must therefore start at plots of the most mature plants. Here additional increases in weight and sugar content of roots are smallest. In addition to external symptoms of beet maturity, it is recommended to observe increases of both weight and sugar content on many fields in order to develop proper plans for harvesting. Beets ripen more rapidly on plots where they were planted before, where not injured by pests, if located near winter crops, where less fertilized by nitrous substances. On plots heavily manured or fertilized by nitrous chemicals,

if planted late and adjoining perennial legumes, beets grow vigorously in the fall. Roots must not be injured during harvesting, as this impairs their storing quality.

Tractor beet elevators dig in rows; roots are gathered by hand and beet implements. Dug up beet roots are cleaned of soil and rootlets with the blunt edge of a knife, the foliage is cut off, the crown cleaned to conic shape, all buds (eyes) removed to prevent their sprouting in storage. The top (crown) itself is left on the root. Cutting the top flat is not permissible, since this leads to considerable loss in beets and sugar. The bottom of the root is cut at the point where the diameter does not exceed 1 cm. This cutting is done on special benches and by hand. Cleaned beets are placed into boxes (without bottom or top). Transportation goes on at time of digging. In urgent cases horse- and mechanical transportation is used. Beets not carried away from the fields are covered with cool soil (taken from lower layers) (5-10 cm) to prevent wilting. All roots should be dug up from the field, none left behind. Foliage should be fully gathered, made into ensile and used for forage.

7 { A remarkable change in yields of sugar beets began in the USSR following the achievement of "500" workers who in 1935 gathered 500-630 c/h. Members of the Politbureau and the Government awarded medals to these women workers and their feats were mentioned in Stalin's speech at the 1st All-Union Conference of Stakhanov workers, brigades and units, who between 1936-39 succeeded in setting similar records. Unheard of yields of 1,100 to 1,300 to 1,400 centners of beets per hectare were gathered, which exceed by far official international records of 950 c/h on irrigated plots in California. This experience is extended to sugar beet fields on large areas. Hundreds of collective farms and state farms average 300-450 c/h and more. }

Stakhanov-sugar beet growers achieve high yields because of their devotion to work, proper organization in production, high labor discipline, and mastery of technique. The essence of agro-practices of stakhanovites consists in the proper application of the entire complex of agricultural methods which ensure maximal correlation between all factors that influence growth and aid yields. Having mastered the prevailing technique of growing beets, stakhanovites have added many new methods to both agricultural practices and chemical means. They introduced additional feeding, additional cultivating between rows, applied local fertilizers, increased norms of mineral fertilizers, deepened plowing to 27-30 cm. Stakhanovites have actually created a new system of agricultural practices in beet growing. Their achievements were demonstrated at the All-Union Agricultural Exhibition.

Seed Growing of Beets. As cross pollinating plants beets are easily regressive, because they lose the positive characteristics acquired and fixed by selection. Uninterrupted selection is therefore necessary to improve varieties; this is the task of selection stations of Glavsakhar (Chief Administration of the Sugar Industry) of the USSR which produces high quality mother seeds for state farms. State farms propagate these on all sugar beet fields (state and collective farms) of their respective regions.

The production of sugar beet varieties is regionalized and takes into consideration the complex of natural (soil and climatic) conditions of regions for which the varieties are grown. Soviet sugar beet selection has provided industry not only with varieties which equal those of foreign production but are considerably superior to them. This has been confirmed by many international varietal tests. Sugar beet planting in pre-revolutionary Russia was based almost exclusively upon imported mother seeds. Successful

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work of Soviet selection stations^{ation} has not only freed USSR from the import of mother seeds of beets but has provided our country with the opportunity to export sugar beet seeds on a large scale.

Certified mother seeds are produced at the following Soviet sugar beet stations: Uladovsk, Ivanovsk, L'govsk, Ramona, Verkhniachesk, Pervo-Maisk, Belo-Tserkov, Veselo-Podoliansk, and Altai. The cleanest and most fertile plots of sugar beet field wedges are assigned to plantings of mother seeds; norms for fertilizing are supplied as in the case of industrial seed, and depend upon soil and climatic conditions. Mother seeds are planted by row planters, width between rows is 36 cm. Period of planting: the middle period of industrial seed planting; norm of planting - 16-22 kg/h. Superphosphate and nitrate are introduced into rows at the same rate as for industrial use. Care is alike but thinning is at 9-11 cm, and on particularly well cultivated plots, amply supplied with nutrients and moisture, even at 6-8 cm. The state farms of Glavsakhar usually provide one hectare of mother seeds to 3-4 hectares of industrial seeds. Applying high agricultural technique and careful storing, beets obtained from one hectare of mother seeds may by spring produce 200,000 roots and over. Digging of mother seed beets is done by beet elevators which cause fewer injuries to roots than manual digging and is of importance in storing. Early harvesting in warm weather is not permissible. Roots are kept stored in underground piles on the fields at 2-3°. A higher temperature causes accelerated breathing in roots, expenditure of sugar, lowers resistance to disease, etc. Trenches are dug for piles (kagat) one month before harvesting to cool off ~~the~~ the entire depth of walls to 2-3°. Piles (in m) are: length -20, width-0.7; depth-0.9. Foliage is cut off immediately

from dug-up beets (resting buds are carefully preserved and 3-5 cm. of petioles are left); immediately after cutting roots are layed in accurate rows in piles.

Before placing roots in piles, their bottom is laid out with a layer of porous soil, 10 cm thick. The beets should not touch each other. Every layer of roots is covered with moist soil (20 percent moisture) to separate it from the succeeding one. After filling, the pile is covered with a layer of soil 20 cm. high. If temperature in piles is 2°, covering is higher. Total thickness of cover is 1.1 - 1.5 m. To localize possible rot in piles soil partitions are built dividing the pile into sections at every 4-5 m.

Manure and mineral fertilizers are introduced under mother seed beets; fields are deeply plowed (26-27 cm). Preparation of the soil in the spring (harrowing, cultivating) is done early and with particular care. Prior to planting the field is marked in all direction (70 x 70 cm.). Every root receives (in addition to initial fertilizers) 150-200 grams of humus, 10-20 g. of superphosphate and 5-10 g. of sodium sulfate of ammonium (all fertilizers are thoroughly mixed with soil). In additional planting only healthy beets are used, removed from piles immediately before. Every beet is planted vertically and firmly surrounded by soil; the soil layer above it is 1-3 cm; several day later, when beets begin to show growth, the soil is raked. Lately seeding machinery has been put to tests. Considering that beets are cross pollinators, seed beds of garden or forage beets should not be any closer than 203 km. Care of planted material consists in cultivating between rows, (in both directions), weed control, additional feeding and pinching of tops of flowerbearing stalks to increase size of seeds. In view of the irregularity in ripening of many seed varieties harvesting up to the present

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time was done by hand. Cut clumps are shaken over canvas (to collect the most ripened seeds), tied into sheaves of 30-40 cm. in diameter and left to dry in piles of 4 in the field on previously prepared platforms. Dried sheaves are covered with straw (hay). Storing in piles is not permissible.

Threshing follows harvesting and drying. Seeds are cleaned of remainders of cut stalks and mixtures and aired. Freshly threshed seeds should be properly aired; they are kept under a layer 20-30 cm. thick. Sugar beet seeds acquire resistance for storing not before one month after threshing, provided their moisture is below 13 percent. Even these seeds should be aired. The hygroscopic nature of seeds is very high and they should therefore be stored only in extremely dry quarters, not on earthen ground or under sheds. Advanced workers have succeeded in obtaining record yields of sugar beet seed of 40-50 o/h.

Principal Pests of Sugar Beets.

1. Nematodes: (Heterodera schachtii) their larvae (length ab. 0.4 mm) penetrate into young rootlets and feed on their juice; beets exhibit a characteristic "wartiness", entire bodies are covered with short hairy rootlets. In severe cases yields are reduced to zero. Methods of control are: long rotation and sterilizing of soil with chlorpicrin.
2. Caterpillar of cutworm moth (Agrotis Segetum Schiff)
3. Caterpillar of sugar beet webworm (Lixostege sticticalis) which feeds on foliage and roots;
4. Sugar beet weevil (Bothynoderes punctiventris germ.) destroys young shoots, while its larvae gnaw at roots;
5. Sugar beet flea (Chaetocnema breviscula fald.) destroys the primary leaves;

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6. Sugar beet beetle ("sveklovichnailia shchitonoska") [Cassida nebulosa L.] feeds on leaves;

7. Sugar beet (maggot or miner) "Klopik" [Poecyloscytus cognatus Fieb] (Hemiptera) sucks sap of leaves and seedling stalks.

General methods of control: 1. digging up last year's beet fields and new plantations; 2. weed destruction on adjoining lands and roads; 3. propagation of pest parasites (trichogramma). Among control methods for individual pests the most important are: 1. catching butterflies of cutworm moths on molasses; 2. catching butterflies of sugar beet webworms and insects of Poecyloscytus cognatus Fieb. in cheesecloth nets; 3. attract and destroy butterflies by keeping ^{open} fires at night; 4. gathering weevils and caterpillars of cutworm moth by hand; 5. spraying of infested plots with poisons (against caterpillars of webworms, weevils and moths); 6. catching moths with special nets; 7. spraying with tobacco preparations and soap-kerosene emulsions (against Poecyloscytus cognatus Fieb.); 8. digging small ditches. Among chemical measures the following are applied: 1. against weevils - spraying with Paris green (25 g, 70 g. lime, 10 l. of water) or with sodium fluoride (100 g., 100 g of molasses, 10 liters of water) or with sodium fluoride (70 g. to 10 liters of water) or barium chloride (400 g, 100 g molasses, 10 liters of water); dusting with sodium fluoride (10 kg/h) or calcium arsenate (8-10 kg/h).

2. against fleas: dusting shoots with calcium arsenate (8-10 kg/h) or sodium fluoride (8-10 kg/h)

3. against Cassida nebulosa L. ("shchitonoska") - spraying with sodium fluoride, (70 g to 10 liters of water) or barium chloride or Paris green (20 g, 40 g of lime to 10 liters of water).

Principal Diseases of Sugar Beets

1. Root Eater, disease of early shoots of beets. At first a light brown moist spot appears above ground part of cotyledon knee², which gradually expands surrounding the plant by a ring. In cases of severe infestation and rapid spread, the plant dies within a few hours. In such cases the sugar beet field may change in appearance within a few days and form empty spaces. If the disease proceeds more slowly and if ^{it} attacks only the cork of the germ, plants may heal by forming additional rootlets. The disease is caused by a complex of fungi (Fusarium, Phoma, Alternaria and Pythium).

These microorganisms develop primarily on weakened shoots of beets susceptible to infestation. Some of these fungi are carried by seeds in planting (Phoma), others are carried in the soil or on vegetative residues (Fusarium, Alternaria).

If infestation is no more than 30 percent, it does not affect the growth of plants too severely and yield may be normal. This is explained by 1. the fact that not all injured shoots are destroyed; 2. healthy plants remain after thinning; only where infestation is severe the disease becomes dangerous. It is at its worse on poorly aired acid-and rung off soils; the combination of low temperatures and ample precipitation contributes to the mass spread of the disease. The most effective method of controlling it is good cultural treatment; of particular significance is timely and adequate cultivating of the soil before planting and healthy seed planting over mineral fertilizers, as well as early rolling. The degree of infestation is weakened by liming. Proper treatment of the soil before planting is necessary so seeds may enter friable, porous soil. Good airing accomplished by repeated cultivating between rows is most important in controlling the disease. Thinning should be as close as possible, to the moment of the appearance of initial leaves.

2. Cercospora, leaf spot, caused by the fungus Cercospora beticola.

Spots are small, ashy-grey with purple margins, forming primarily on center

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leaves that have completed their growth. Appears in the middle of summer;
develops strongly towards fall under conditions of increased humidity. Causes
mass drying of leaves. Spread in the summer by spores which form a gray film
on spots. Winter as dormant mycelium on vegetative debris. Infestation of
the foliage depresses assimilation and leads to the growth of new leaves at
the expense of reserve substances of roots reduced in sugar content; it pro-
longs ripening and deteriorates beets for storing. Measures of control:
harvesting of cut foliage (ensilage, digging-in), deep fall plowing, crop
rotation, rolling, weed control, repeated spraying or dusting with Paris
green, preparation AB. The initial spraying or dusting must be of preventive
type and start long before the disease makes its appearance.

Mosaic of sugar beet is a virus disease which causes irregular leaf col-
oring. Along with normal green foliage, light areas appear in the form of
spots of round or indefinite shape. It may begin towards the end or early
July, increasing in the fall. The disease is transmitted from plant to plant
by aphids. The infectious origin over-winters in beets stored for planting.
In the spring it is first observed on plantings from which it is transmitted
to beets of the first year. Several weeds may also serve as sources of in-
fection. The results of the disease are: reduced yields of seeds in mother
beets and lower sugar content in beets of first year. Control: Considerable
distance between plots of mother beets and industrial beet fields grown for
seed. Use of plants from uninfested fields for seed stock; control with
mosaic transmitters, particularly on seed stock fields; weed destruction;
early planting and application of methods ensuring vigorous and close devel-
opment of beets, especially during early vegetation periods.

4. Other less prevalent diseases of beets are: 2) rot of "heart",

chiefly resulting from lack of boron in the soil; b) mildew; c) pseudo-mildew;
d) rust; 3) root canker; f) root scab.

Forage beet. (Beta vulgaris L.) differs from sugar beet in its larger water content and lesser amount of sugar. Raw protein of forage beet represents $2/3$ amido-acids and only $1/3$ albumen. In shape forage beets are divided into the following groups: 1. long, straight or bent, deeply placed in the soil ("mammut", "steer horn"; 2. conic-shaped, elongated-oval; 3. cylindrical or bag-like with root extending above soil ("Eckendorf", "Armin-Kriven-sk"); 4. round varieties with ball-like root ("Yellow Oberndorf", and "Red Oberndorf"); the half-sugar (white and rose) beet approaches closely forage beets, except that its sugar content is higher, it contains more dry substances and shape of its root is conical. Long beets are richer in dry substances, while round and shorter beets contain more water. The largest yield among root crops is derived from cylindrical varieties. Lengthy and ball-shaped varieties produce smaller yields in beets but have thicker foliage. Half-sugar beets are inferior to forage beets in yield but have greater drought resistance and stand winter storing well. Beets are at a depth of $1/4$ - $1/5$ in cylindrical and round varieties, and in harvesting they are easily pulled out by hand. They adapt to less deep soils and easily stand transplanting. The best varieties are: "Yellow Eckendorf", "Armin-kriven-skalia"; "Barr"; "Mammut" (Mammut); "Ideal Kirsche", and the semi sugar white and pink beets.

Yield of forage beets depend upon cultural treatment. In 1937 average yields amounted to 150-200 c/h, although several advanced farmers obtained yields of 2,000-2,500 c/h.

Forage beets take second place in farm crop rotation after potatoes, legumes, hemp, tobacco, and other crops which respond to fertilizers and deep cultivation. In field crop rotation forage beets may be introduced only in well cultivated soil. In order to obtain high yields ample manuring is essential in addition to mineral fertilizers. Density and planting of seedlings are significant. Normal density is 75-80,000 plants per hectare (50-55 cm x 25 cm); planting of seedlings is particularly important on heavy and raw soils. Large increases in yields are obtained from additional feeding (provided there is additional watering), timely thinning (if planting was by seed) and adequate deep cultivation.

HARVESTING of forage beets is done before early frosts when lower leaves begin to dry and rows are more noticeable. Forage beets are stored in special storing quarters or in holes dug in fields. The foliage of forage beets represents a nutritious food item.

GARDEN BEETS (Beta vulgaris L.) Two kinds are grown. Beta vulgaris var. esculenta and the foliage Mangold, (Beta vulgaris var. cicla). Garden beets are used in soups, sauces, garnishings, pickling, mixtures of dry vegetables. They take second place among root crops after carrots. The fleshy fruit develops in concentric rings from upper part of the root. The color is red or deep red. Mangolds have strongly developed petioles and large leaves. Beets of the most valuable table varieties are characterized by smooth rings and even intense red coloring. To determine ring shape the VIR scale is used. The best varieties are: 1. flat and flat-round: "Egyptian" and "Crosby", (early varieties ripening in 80-90 days); 2. round: "Bordeaux", variety of Soviet selection, good yield, even coloring, no rings, "Eclipse" (100-110 days); 3) long varieties: "Erfurt" (130-150 days).

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CULTURAL PRACTICES. In crop rotation garden beets are in the second year planted on fresh organic fertilizers (if soils are poor, also in the first year). Planting in the central zone must be done no later than by May 15. Planting is ribbon-like, in two lines, distance between ribbons 50 cm, between lines - 2 cm.; depth of cover is 2.5 - 3.5 cm. Norm of planting is 18 kg/h. Sprouts appear in 8-12 days. Care: timely thinning; weeding, when necessary, cultivation between rows, additional feeding. Final distance between plants in rows - 6 to 10 cm. Harvesting before early frosts set in. Long varieties are plowed with beet elevators; round varieties are pulled out by hand.

Selected beets are put short, sorted and packed into bags containing 50 kg. In the winter beets are heaped in piles, trenches, or sheds of vegetable storage bins. Record yields were obtained in 1937 at the collective farm imeni Il'icha, Kuntsev region, Moscow oblast', by the brigade headed by comrade Okasova (1,400 c/h).

MANGOLD is grown in the same manner as other forms of beets. Spinach varieties are: "Swiss", "English-eternal", and petiole-varieties: "Yellow Improved", "Lucullus". Thinning of first crops is in June, of second crops in early September. Mangolds are also grown in hothouses.

Special beet varieties are: "Yellow Chile" and "Red Chile", which are of ornamental interest.

End of article

L.A.B.
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Translated from the Russian by R. G. Dembo

Tasks of the sugar-beet state farms in 1947 [Translator's title]

Before our Great National War the state farms were the leading highly mechanized agricultural enterprises with high crops of sugar beet and of cereals, grasses and with a well developed productive husbandry. They were a good example of correct and skillful farming and promoters of progressive agricultural technic among the surrounding collective farms.

The German invaders caused great harm to the sugar-beet state farms. A great task we were facing in restoring these farms.

From the very first days since liberation from the invaders of sugar beet raions started a strenuous work in restoring the sugar-beet state farms.

In 1945 already many sugar-beet state farms grew quite a good harvest of sugar beets and of cereals, fulfilled the state plans early, carried out a tremendous work in raising productive working cattle. In 1946, despite unfavorable conditions, in a series of sugar beets state farms where an intensive bolshevist struggle has been carried out, where high agricultural technic has been applied, good results were also obtained. Ol'shansk sugar combine of the Kiev sugar-beet trust collected a harvest of cereals 18.5 c/ha and fulfilled the grain production of 101.5 percent. Aleiskii sugar combine of the Altai trust collected a harvest of cereals 17 c/ha, and sugar beets seeds 22.5 c/ha; Taldy-Kurgansk sugar combine Alma-Atinsk trust received cereals 20 c/ha, sugar-beetseeds 21, plant sugar beets 291 c/ha, etc.

Hundreds of progressive workers of field production and of husbandry succeeded victoriously in restoring sugar beet state farms and their further development.

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The tractorist Panenko (Lenin sugar combine of the Kharkov trust) had plowed during the first half a year of 1946 with the tractor CETZ 916 ha. The group of Novo-Bykovsk sugar combine of comrade Khriapa had grown 24.6 c/ha of sugar-beets. The calf dealer of the Krasno-Iaruzhsk cattle farm, comrade Shanina had grown 25 calves with the average weight gaining of 800 g. in 24 hours, etc.

And yet many sugar-beet state farms did not fulfill their tasks during 1946; they did not carry out the outline on sugar beet seeds, on sugar beets, on cereals, grasses and are indebted to the government.

Therefore during 1947, the second year of the new Five-Year-Plan, the responsibility of sugar-beet state farms is increasing as to the production of high yields of sugar-beet seeds, of cereals and grasses. This year the sugar-beet state farms along basic divisions and indexes must lift themselves up to prewar work level, revive former glory of the progressive farms. The basic requirement of Stalin Five-Year Plan should be fulfilled: "To ensure a model production in the state farms, to increase considerably the crops of agricultural plants and the productivity of husbandry, to increase the production on tractors, combines and in other agricultural machines and to decrease the cost price of agricultural production."

What should we do in order to fulfill these tasks?

Already in fall of 1946 the majority of farms advanced along the road of improving agricultural technics - deep plowing and tillage were carried out, the sowing of winter crops on fallow fields has been carried out on time.

The basic factor in growing high crops of all field plants is the struggle for accumulating and storing moisture. This measure is especially

significant in connection with the lack of moisture last year and the small amount of rainfall in the first half of winter. The state farms must first of all stop the snow fall along the fields destined for sugar-beets, on winter sowings and on grass seedlings. Each centimeter of snow cover on the field of one heotar yields about 2.5 thousand pails of water. The availability of a great amount of plowed land creates the problem of storing moisture in spring. Therefore, there should be renovated the old equipment: scrapers, ploughs, cultivators and also produced new ones in a great amount.

How significant is a scraper in conserving moisture and in increasing the sugar beet crops is well known from the experience of Stalin state farm. In this state farm upon fields where the scraper has been applied the soil moisture before sowing was 1.5-2.5 percent higher in comparison with fields where the scraper was not applied. According to the data of Verkhniach selection station the scraper increased the sugar beet crops at 5-11 percent higher as compared with two passages of the plough.

It is also necessary to pay attention to the preparation of tractor trailers which enable to carry out an aggregation of the agricultural inventory and to fully utilize the power of tractors. There are many examples when, due to incorrect aggregation, the tractor power has been poorly utilized.

After the war in many sugar-beet state farms the level of small mechanization decreased which, of course, was reflected on the crops. In 1945 for the production of 1 h. of sugar beet there was spent 30 percent more labor power than even in applying the simplest mechanization.

Some workers tried to explain the absence of mechanization by lack of a necessary agricultural inventory. Of course, it is not so. The reason is that these workers underestimate the significance of small and medium

mechanization, they do very little in restoring hoes, ploughs, and they do not try to utilize with maximum effect the existing equipment.

Let us take as an example the sugar-beet state farms of the Khar'kov sugar-beet trust. In 1945 at the trust of the sugar-beet factory less than one friability of the soil between rows has been carried out, and the digging with hoes was done only on 6.4 percent of the entire field. Quite/satisfactory^{un} was the mechanical ploughing of plantings, for instance. Podserednian sugar beet state farm carried out the ploughing once and obtained a harvest of 8.2 c/ha, and the Parkhomovsk sugar-beet state farm which carried out the ploughing three times obtained high crops of sugar-beet seeds 14.5 c/ha. These facts do not need further explanations.

If we were able to restore almost from scraps many tractors, combines, threshers, then we may say with assurance that with the same success we are able to restore equipment of medium and small mechanization.

In 1947 the sugar-beet trusts and sugar-beet state farms must make the decisive step for the introduction of various types of mechanization for sugar-beets. Without mechanization it is impossible to achieve the introduction of high agricultural technic, the increase of crops and the decrease of expenditure for labor and net cost. We should take into consideration the fact that the conditions of 1947 require urgently a drastic decrease in labor power for the production of sugar-beet plants.

A successful introduction of mechanization is closely related to a good technic of sowing. Therefore it is necessary to pay attention to the fact that the presowing tilling of the soil would even out the field surface, so that there would be no furrows, bald patches, huge clods, that the sugar-beet rows would be strictly straight, and the between rows would be even along the entire field.

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The second year of the Five-Year-Plan should become the year of a definite lift in sugar beet production, in the yield of sugar-beet seeds, factory and mother beet. The state farms must secure perfect quality of sugar-beets, that the yield could be an example, the pride of our work. The duty of sugar-beet state farms is to head the struggle for a high, rich harvest and by this example to attract the neighboring collective farms.

Each worker should understand that only as a result of a drastic increase of sugar-beet crops are we able to secure a general increase of crops of all plants of sugar-beet crop rotation.

What is most important in the fulfillment of this task? In connection with some shortage in sugar-beet seeds during the last two years and with the increase in sowing of sugar-beets in collective farms the program of planting in 1947 has increased. At the average they will occupy 50 percent of the entire sugar-beet wedge. Many state farms will have mainly plantings and mother sugar-beets. Such a great amount of sugar-beet seed production requires a serious preparatory work, a well analyzed outline, correct organization of all work starting with the planting and ending with harvesting. This year a high crop of sugar-beet seeds; the advanced workers introduced many new ideas, enriched agricultural technic.

For instance, Orekhovskii sugar combine of Poltava sugar-beet trust had produced at the average in 1945 upon the field of 300 hectares 26 c/ha of sugar-beet seeds. Individual groups obtained unusual yields the team of comrade Gladkikh produced 42 c/ha, the team of comrade Belonoshka 40 c/ha.

As the experience of the last two years indicated, in order to obtain a high yield of sugar-beet seeds, the most important is the evenness of the mother material, a careful preparation of the tubers before planting.

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The progressive sugar-beet state farms practiced in 1946 the digging out of the tubers 8-10 days before planting, with a careful sorting and discarding of the unfit. The tubers which were dug out were kept before planting in heaps covered by a layer of ground of 25 cm. which enabled to select better tubers and with a repetitive sorting before planting to discard the tubers which did not give any sprouts. This caused the growth of tubers up to 100 percent, increased the crops in individual links of Siniavsk sugar combine up to 18 c/ha. The participation of teams during the planting of tubers upon their field is of great significance. In Ol'shansk sugar combine, where the planting was without teams, the yield was 11 c/ha, and wherever a team did the planting the result was 13 c/ha. The introduction of fertilizers gave good results. Thus, in Smeliansk sugar combine the link of comrade Goloborod'ko which brought in 25 t of dung in fall and 4 T dry sand accumulated 14 c/ha of sugar beet seeds.

The task is that every trust or sugar beet state farm would follow the experience of the advanced workers in high crops of sugar beet seeds, would teach the methods of the agricultural technic applied by them to all brigadiers, links and would introduce those methods next year in all branches, in all fields.

Quite instructive is the example of struggle for a high yield of the Novo-Bykovsk sugar combine of the Chernigov sugar beet trust whose work has been recorded in a special order from Minister, Comrade Zotov.

The director of Novo-Bykovsk sugar combine, comrade Kitkenko, organized and attracted into active participation the workers and the employees of the plant to the production of high yield of sugar beets. During two years ~~they~~

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they harvested 18 c/ha upon a field of 40 ha. The workers of the plant, without jeopardizing their regular work, received additional salary in money and sugar and gave the country hundreds of centners of high quality seeds.

If the workers of other sugar combines would follow the example of New-Bykovsk combine, this would lighten the problem of labor power.

This year the state farms have all the possibilities of producing high crop of factory and mother sugar beets. It is necessary to ensure full sprouting and to plant upon one hectare no less than 100 thousand roots at the moment of digging. All agricultural technical measures should be utilized in the fulfillment of these two exponents. We do not know yet what the meteorological conditions will be this spring, but, even in considering lack of moisture in the ground from last fall, we are able to say that we should not delay with the sowing of sugar beets even for an hour and it has^{to} be carried out in a very short time.

It is necessary to indicate that in 1946, under conditions of extreme drought, those state and collective farms which have fulfilled strictly the entire complex of agricultural technic obtained at the most critical moment of moisture deficiency strong sprouts of sugar beets which endured the drought and yielded a good harvest.

Experience of many years and mainly the experience of advanced workers indicate that the density of planting sugar beets after sprouting of 115-120 thousand of plants for one hectare and of 100 thousand at the beginning of digging with the application of elementary agricultural technics will yield 250-350 c/ha upon large fields. The famous sugar-beet grower, comrade Parmuzina, harvested in 1945, 1003 c. from one ha. At the beginning of digging she preserved 127.5 thousand tubers per ha. The leaders of trusts,

agricultural workers, brigadiers and teams must urge this year a struggle for a dense planting upon all fields of sowing of factory and mother sugar beets.

The experience of the Bakhmach sugar-beet state farm of Lenin Order on the rationalization of sugar-beet work is worth mentioning. In this sugar-beet state farm instead of entire sprouting, is carried out the sprouting across rows with the simultaneous light digging of the sprouting rows and by leaving 5-6 bouquets on one meter. A final working out of the bouquets occurs after the second digging of the field. The entire plantation breaks through the row, loosens simultaneously and is dug twice as fast as during the full breach; during the breach and the survey the sugar beet receives four breaches. During this method of cultivation there is considerably less depression on the part of weeds and loss of moisture; labor power amounts only to 42 men per hectare.

In 1945 the Bakhmach sugar beet state farm, by applying this method of cultivation, obtained a yield of mother sugar-beet on the field of 211 hectares - 250 c/ha and factory sugar beets up to 200 c/ha. In 1946 the sugar-beet state farms of Chernigov sugar trust worked with sugar-beets according to the method of Bakhmach state farm upon a field of 450 ha and obtained in all instances good results; for instance, Nosov sugar-beet state farm obtained about 250 c/ha on a field of 92 ha of mother sugar-beet.

Numerous experimental data indicate that by carrying out all the agricultural technical measures, directed towards the improvement of winter and food regime of the soil, the coefficient of moisture utilization increases. Under these conditions, for instance, for the formation of 1 c of sugar beets over 1 mm. of moisture is consumed; for the formation of 1 c of sugar-beet seeds

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14.6 mm. of moisture is consumed. If we figure out that the average amount of waterfall in the raions of the distribution of our sugar-beet state farms is 450-550 mm. this indicates the necessity of posing before the state farms the task of increasing next year the struggle for the sugar beet crops to 300-350 c/ha and sugar beets seeds 20-25 c/ha.

Without correct grass rotations it would be impossible to achieve an increase in fertility and in obtaining high immune crops of all plants. Therefore it is necessary for the sugar-beet state farms of carrying out considerable work on crop rotation during the current year. The sugar-beet wedge and grasses should in 1947 reach the prewar level.

The law of the Five-Year-Plan requires that in collective and state farms should be introduced correct crop rotations "with the application of grass sowing using widely grass mixtures - legumes (especially clover and alfalfa) and of cereals of many year grasses."

The basic agricultural technical requirement of grass field of grass system of agriculture - is the cultivation of mixture of many year grasses. Meanwhile, many sugar-beet state farms are upon incorrect and wrong road of sowing mainly of only legume grasses. They forgot that the structural-forming potential of the mixture of perennial grasses is much higher than of only legume grasses. According to the data of Ivanovsk, selection station, the percentage of structural elements in ploughing field is 0-25 cm. on clover plus cereal grasses 5 percent higher than on pure clover, with esparsette plus cereal grasses higher by 9 percent than on pure esparsette. According to Verkhniachesk and Ivanovsk stations on grass mixture, the crops of the succeeding plants increased on spring wheat up to 4 c, sugar-beets up to

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40-50 c and sugar beets up to 3 c from 1 ha; the mixture of grasses in comparison with the sowing of only legumes yield an increase of crops of hay up to 25 percent and its quality improves considerably.

In 1947 the sugar-beet state farms must carry out important work in introducing the grass rotation systems, critically survey crop rotation and correct the errors committed before. In crop rotations of sugar-beet state farms fallow land occupy a great and important place. Fallow land is the second link in its importance for correct crop rotation. Before the war many sugar-beet state farms showed examples of good cultivation of fallow lands. Black April and May fallow lands were of considerable amount. Repetitive underlayer cultivation of grasses during the summer, its keeping up before sowing in ideal cleanness with a constant loosening and mulching the upper soil layer were law in the work of every specialist in sugar grower. We must this year fully restore the system of cultivating fallow land as it existed before the war. Almost a full insurance of sugar beet state farms by plow land and along with this the possibility of accomplishing the spring work quickly enable us to use the fallow land in April and May and to build still a stronger foundation of a high crop in 1948.

Responsible tasks are before the sugar-beet state farms in the field of husbandry. According to the outline of 1947, the increase of cattle per capita amounts to 21 percent, pigs - 11 percent, oxen - 25 percent, horses - 8 percent; it is forecasted a further increase in the productivity of cattle, in milking - 10 percent increase is planned. An organization of twenty new husbandry farms of cattle, horses and pigs is planned. All this could be fulfilled only based upon the organization of a strong feeding base.

It is necessary to introduce most thoroughly correct feeding crop rotations which would produce the necessary amount of green mass, hay, tubers, silos and other juicy feeding.

This work should be done mainly by tractors, combines and by other agricultural machines. Three quarters of all work on sugar beet state farms will be carried out in 1947 by tractors. A good work of the tractors will decide the success of the enterprise. In 1945 and 1946 a series of trusts (Voronezh, Kursk, Zhitomir, Chernigovsk) have poorly utilized the tractors which led to the lagging of agricultural work; thus, the Kursk sugar combine of Voronezh sugar-beet trust, as a result of poor tractor work, carried the sowing 60 days and accomplished it only on June 15. As it showed on the results, we are able to see from the following, most indicative data; barley sown before May 5 yielded 15 c/ha, sown before June 10 perished; oats and spring wheat sown before May 5-10, yielded 13-18 c/ha, sown before June 10 - 4 c/ha.

As a rule, the state farms which delay spring sowing, not only lose in crops, but interfere in the succeeding work: the lifting and tilling of fallow land, the sowing of winter crops, etc.

The experiment of progressive workers in utilizing tractor parks teaches that the success could be secured not only by highly qualified remodeling of tractors, but by a correct organization of exploitation of the tractor park as well. It is necessary to follow a careful technical care for tractors and for attached agricultural machines. For this purpose it is necessary to instruct mechanics, brigadiers, tractorists, hookers the technical methods in taking care of machines; empty spots should not be overlooked, hence the tractors should have a well planned route; correct aggregation for the full loading of power of every tractor should be organized; it is necessary to ensure

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two shift of tractor work for 20 hours a day. For this purpose it is necessary to introduce a corresponding arrangement of the working day in brigades and to control strictly its fulfillment; it is necessary to liquidate entirely the standstill of tractors on account of their poor service, to organize the charging of tractors by fuel and water at the station, and by seeds during its running; to organize in the tractor brigades good food, living quarters (tractor booths and others), daily strict registration of production, expenditure of fuel and of the quality of accomplished work fighting decisively bunglers and trouble-makers; to organize widely socialistic competition among the tractorists, brigades, links. By following these basic rules of exploitation of machines the tractor's productivity will increase considerably and will yield higher crops.

Along with the accomplishment of great production tasks, in the center of our attention should be the problems of improving the life of workers and of specialists sugar-beet state farms. Our community houses should be always kept orderly and clean, as well as our dining rooms, clubs. Each department of the sugar-beet state farm should by its external appearance and order in all corners reflect high organization and cultural life of a great socialistic enterprise. For this we don't need great expenses, only daily care is required on the part of supervisors, of high and low rank.

For the creation of a strong provision base there should be reflected in the plans and in the work of 1947 the development and improvement of work of additional branches: apiculture, pisciculture, poultry raising, pig feeding on the waste of common food, orchard production, garden production. We must pay attention to the organization of watering gardens, using for it local reservoirs, the erection of the simplest pump station and also free energy of already constructed hydraulic stations.

Alekseev

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Thus are the basic tasks of sugar-beet state farms for 1947. No doubt, a great army of workers, specialists of sugar-beet state farms will give all their power and knowledge, so that next year they would be able to advance on the road of restoring sugar-beet state farms and their further development and will honorably accomplish their great tasks.

L.A.D.
9-17-51

Sveklovodstvo (Sugar beet Growing).
 In Sel'skokhoziaistvennaia Entsiklopediia,
 Ed. 2, v.4, p. 98-100. Moskva, 1940. 30.1 Se42

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SB-120

Translated by S. N. Monson

The culture of sugar beets began in Russia in the early nineteenth century. In 1914 the planted area of pre-revolutionary Russia consisted of 753,534 hectares and was concentrated primarily in the Ukraine and Kursk, Voronezh, and Tambov gubernii. Limited areas at Orlov and Tula gubernii and Kuban' also grew sugar beet crops. Within the boundaries of USSR (as of August 1, 1939) the area planted under beets amounted to 648.7 thousand hectares of which private land and sugar refinery owners possessed 499.5 thousand hectares, while peasant households, practically all under kulak ownership, held 149.2 thousand hectares. After the revolution the need for sugar increased drastically in the country and areas of sugar beet planting were considerably extended. In 1938 the area planted with industrial sugar beet at state and collective farms comprised 1,180.3 thousand hectares (including 1,127.3 thousand h. grown at collective farms). The number of state farms producing sugar beets was 180, of collective farms 21 thousand, all serviced by 938 machine tractor stations (MTS). Sugar beet planting in USSR represents 35.4 percent of the world's area of beet planting. In planted surface USSR occupies first place among all countries in the world.

At present beet crops in the USSR have been moved into such regions where beet growing was unknown before the revolution (Kazak SSR, Kirgiz SSR, Georgian SSR, Armenian SSR, Altai and Primorskii kraia, Saratov and Novo-Siberian oblast' and Bashkir SSR.). Soviet agronomy demonstrated that sugar beets could be grown at Arkhangel'sk, Vologda, Kirov, Omsk, Cheliabinsk, and other northeastern regions. Yields of beets, as a result of

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special measures undertaken by the Party and the Government, are increasing steadily from year to year, following a drastic decline after the first years of collectivization (see Yield).

At the 17th Convention of VKP(b), comrade Stalin disclosed in this report the causes of the above decline stating: "While oil crops suffered only slight variations, retaining their high yields compared to pre-war levels, sugar beets in the regions where reorganization of agriculture was proceeding at its highest tempo, entering the reorganization period last, suffered the greatest slump in the last year of reorganization, i.e. 1932, and brought production down to below pre-war level."

The gross yield of sugar beets in 1937 amounted to 218.6 millions of centners as compared to 109.0 millions of centners in 1913. In gross yield USSR occupies first place among sugar beet planting countries. The relative weight of USSR in world production of sugar beets amounts to 26.5 percent. The third five-year plan, concerned with the development of the national economy, envisaged by 1942 a yield of up to 282 millions of centners, at the rate of 235 c/h.

The Party and Government undertook various measures to ensure collective farms planting sugar beets with the most modern technical equipment, to promote the economic organization of farms and increase sugar beet yields. Contract terms were altered. The new contract agreements provided that whenever the set amount (norm) in delivery of sugar beets per hectare is overfulfilled, the collective farm receives an additional compensation amounting to 400 percent of the basic pay for its surplus. The agreement takes into consideration the correlation of social interests at a collective farm with those of individual collective farmers. All farmers raising sugar beets

are joined in groups of links which are assigned fixed plots for beet growing. The yield of beets is computed separately for every link. One half of the additional premium payments earned by the collective farm is distributed among links producing the highest yields, on the basis of labor days spent by every collective farmer. Farmers receive in addition sugar, beet pulp, molasses, in proportion to invested labor days.

Table 1

Equipment of Sugar Beet Growing Collective Farms with Modern Technical Means (quantities of items)

Name of Machine and Equipment	1934	1938
Tractor - plows	-	18.866
Sugar beet planters (adjusted to 12 rows)	7.500	12.597
Inter-row cultivators (adjusted to 12 rows)	215	12.818
Plant-feeders	-	10.965
Agricultural equipment for pest control	7.034	11.884
Sugar beet elevators(?)	2.707	17.764

Collective farms are equipped with modern technical implements. The heaviest and most labor consuming tasks in sugar beet production are mechanized. The degree of mechanization at collective farms and its expense in the past few years are presented in table 1, while level of mechanization is listed in table 2.

Table 1

**Level of Mechanization of Principal Labor Processes on Sugar Beets
at Collective Farms (in Percentage)**

Designation of work done by Tractors.	1934	1937
Sugar beet planting	6.7	84.3
Inter-row cultivation	12.6	52.4
Additional feeding	-	59.2
Digging	9.2	78.3
Transportation of sugar beets	26.0	32.1

Over 70,000 tractors and 35,000 machines are at work on sugar beet fields of collective farms. Creative ambition is, however, not satisfied with these accomplishments. Young Soviet engineers, technicians and collective farmer-inventors labor persistently to produce a sugar beet combine that may permit digging, cleaning and cutting of sugar beets with ^{the} least expenditure. Engineer Koren'kov designed a machine which digs and piles sugar beets. Increases in trained personnel equal levels attained by mechanization. (table 3).

Table 1

Special Agricultural Personnel Employed at Sugar Beet MTS.

	1934	1937
Agronomists	4.048	5.549
Technical personnel	3.325	8.968
Combine drivers (Operators)	-	7.693
Tractor Drivers (Operators)	29.006	106.104
Chauffeurs	6.896	18.888

Application of fertilizers under sugar beet crops increased from year to year. (table 4)

Table 4

Introduction of Mineral Fertilizers under Sugar Beet Crops (in Tons)

Years	Total amount of mineral fertilizers	Including		
		Soluble phosphates 14 %	nitrogen 20 %	potassium 40 %
1934	382.958	362.750	11.763	8.445
1935	633.124	544.980	57.743	30.401
1936	898.921	562.400	103.949	133.481
1937	898.627	635.384	131.546	131.697

225 agro-chemical laboratories were established to improve the application and storing of fertilizers at MTS engaged in planting sugar beets.

Sugar beets are grown in special rotations with perennial grasses, grain crops, and cereal-legumes. Further success in sugar beet production is connected with the introduction of proper crop rotations and planting of perennial grasses. The following problems should be solved in sugar beet crop rotation: 1. Proper development of principal branches and crops at collective farms to ensure the fulfillment of government assignments in developing agriculture in every region. In extending the area of perennial grasses it is necessary to preserve, wherever possible, and to extend areas of cereal plantings. In introducing crop rotations conditions essential for increasing yields of crops under rotation must not be obstructed. Crops must include those essential for collective farms, i.e. grain, legumes, potatoes.

2. The establishment at every collective farm of a firm forage base ensuring development of ~~and~~ husbandry and productivity of cattle. The required amount of planting of grain-forage crops must be determined for

for this purpose and the necessary area established for/giving consideration to to increase in soil fertility. In determining upon summer keep of cattle, it is necessary to fix the amount of farm crop rotation.

3. Ensure increase of soil fertility and definite, uninterrupted growth of yields. This requires assignment of the necessary area of planting of perennial grasses and establishing their role in rotation. Sugar beets and winter wheat should ~~in the first place~~ be provided with best predecessors. first. Rotation should proceed under agricultural measures and fertilizing that ensure high yields. The volume of work on the respective crops should correspond to the amount of available labor and means of production at collective farms and MTS, so that the most important agricultural methods may be carried out. Proper sugar beet rotation must ensure the fullest use of labor and means of production at collective farms and MTS in separate basic agricultural periods. In introducing rotations shape and direction of fields under crop rotation and of brigade plots must be determined with the view of creating the most favorable conditions for the best use of machinery.

The average yield of sugar beets throughout the Soviet Union is growing annually in connection with application of fertilizers, mechanical means and the raising of the cultural level of collective farm land. 1935 will go down in history (of Soviet sugar beet planting) as the first year when the Stakhanovite practices ensured drastic increases in sugar beet yields.

The promise given by komсомolka M. Demchenko to comrade Stalin at the 2nd All-Union Conference of Collective Farmers Shock workers, to secure yields of sugar beets no lower than 500 o/h, served as a signal for the expansion of Stakhanovite speed-up. The promise given to comrade Stalin became a matter of personal honor not only to M. Demchenko, but to hundreds of other women-farmers. To attain the goal of 500 o/h: hundreds of women-farmers formed links all over USSR. 32 other links succeeded in attaining the goal;

of c/h. Many advanced farmer beet growers earned the highest award, the order of the Union of SSR.

In 1935 the "500" graders proved that yields in sugar beet growing regions of the Union could be produced in amounts of 650-700 c/h. In 1936 the women "1000" graders obtained yields in sugar beets of 1.100 - 1.300 and 1.400 c/h, yields which surpassed all known world records in capitalistic countries.

Competition is growing steadily from year to year, placing into the foreground outstanding farmers-"Stakhanovtsy" who attain world records in yields of sugar beets. In 1938 over 150,000 links, about 30,000 brigades and over one half of all collective farms were in competitions. Socialist competition and Stakhanovite methods at work in tens of thousands of links ensured during an extremely dry year (1938) yields in sugar beets which exceeded even those of 1935 and 1936. Stakhanovite methods are used at present not only in individual links and brigades but ^{throughout} at entire collective farms, MTS and even administrative regions.

Thousands of collective farms have attained high and stable yields of sugar beets. The average high yields are given vivid illustration in table 5.

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Table 5

Yield of Sugar Beets At Advanced Collective Farms in 1938

<u>Name of Collective Farm</u>	<u>Area of Sugar Beet (in h.)</u>	<u>Yield in c/h</u>
Imeni Lenina, Chmerovets region, Kamenets-Podol'sk obl.	148	394
"Chervonny Prikordonnik", Yampol'sk region, Vinnitsa obl.	150	335
Im. Kuibisheva, Shashkov region, Kiev obl.	282	270
"Do Kommuny", Yampol'sk region Vinnitsa obl.	240	305
Im. Kuibisheva, Baltaki region Moldavian ASSR	40	400
"Socialchi", Kantak region Kirgiz SSR	65	475

In Moldavian ASSR, in 1938 close to 30 collective farms obtained yields above 300 c/h. At Kamenets-Podol'sk oblast' over 200 collective farms succeeded in producing over 250 c/h. More than 20 collective farms at Kantak region, Kirgiz SSR, raised an average of 350 c/h of sugar beets.

Socialist competition directed towards attaining high yields in sugar beets spread over entire administrative regions. NKZ of USSR recorded the following highest average yields among the individual administrative regions: (table 6)

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Table 8

Highest Average Yield of Sugar Beets in Cities and Regions of USSR. (in c/h)

Years	Oblast' and republic	Region	Average Yield
1933	Voronesh, RSFSR	V. Khavskii	145
1934	Kiev, UKSSR	Kamenskii	166
1935	Voronezh, RSFSR	V. Khavaki	217
1936	Vinnitsa, UKSSR	Yampol'sk	266
1937	Kamenets-Podol'sk, UKSSR	Volochinsk	352
1938	Kirgiz SSR	Kantak	355

Even higher than the total yield of sugar beets was the amount of sugar obtained per unit of area in the past years. The average sugar content of beets in USSR in 1935 amounted to 18.14 percent, a record level. Stakhanovites succeeded in increasing this figure. Thus, Maria Pipipenko (collective farm "Chervoda Ukrainy", Lozov region, Khar'kov oblast') raised beets containing 19 percent of sugar from a total yield of 1.140 c/h; Irina Litvinova (coll. farm "Krasny Pakhar", Voronezh obl.)--20.3 percent of sugar. Few regions of sugar beet planting are known to produce higher sugar content. The average yield of beets at Kazakhstan and Kirgiz SSR exceeds the Union average, while sugar content of beets is 18-19 percent, in individual collective farms even larger. At Belovodsk region (Kirgiz SSR), (collective farm "Erl Marx") sugar content of beets was 19.8 percent; at Kalinin collective farm - 30.2 percent; at Irunze collective farm - 20.8 percent, at "Gorny skotovod" - 21.2 percent, etc.

L.A.P.
9-14-51

Mol'nik, N. K.

Transl. 210: Sugar Beets SB-83

Measures to increase the yields of sugar beets.

Trkh. Promysh. 20(4): 3-7. Apr. 1947

65.8 SA2

ED. September 13, 1951

Translated from the Russian by R. G. Dembo

The resolution of the February plenum of the Central Committee of the All-Union Communist Party(b) "On measures for increasing agriculture during the post-war years" indicated a program for a speedy restoration and lift of agriculture, for the production of abundance of foodstuff for our population and of raw material for our light industry. The increase of yields of agricultural products and the expansion of gross harvest of grain, sugar-beets and of other plants is the most important task of socialist agriculture and in the first line of its leaders--the state farms. The plenum of the Central Committee of the All-Union Communist Party(b) ordained wide measures in transforming state farms into model high-producing farms.

One of the basic conditions for the growth of harvest and for the expansion of gross harvest, especially of sugar-beets, is the wide utilization of the achievement of advanced agricultural science and the introduction of the progressive experience of the Stakhanovites into production.

Of course, we should not overlook the unfavorable meteorological conditions of 1946, nevertheless they should not justify entirely the low yields which were obtained. The real reasons for such low yields were not so much the meteorological factors as the defects which occurred in agricultural technic and with a better organization of labor and of production measures harvested this year better crops than their neighbors who did not fulfill the requirements of agricultural technic, who were unable to organize correctly labor and man power in producing high crops. The results of the agricultural season of last year indicate that many of our state farms are still depending upon external conditions which is the result not in the

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lacking of means of productions, but mainly of not having utilized them. This has been confirmed by data of yields in state farms and in trusts during 1946.

The state farms of Sumsk sugar-beet trust (Manager, com. Ponomarenko, chief agronomist com. Kuliantsev) obtained the average of 7.9 c/ha of grains, 120 c/ha of sugar-beets and 5.9 c/ha of sugar-beet seeds. This yield is even for 1946 too low, especially for sugar-beet seeds. Nevertheless the First-of-May Sugar-Beet State Farm of this trust obtained a yield of 11.2 c/ha of grain, 235 c/ha of factory sugar-beets and 9 c/ha of sugar-beet seeds. This means it doubled the average crops for the trust on sugar-beets, and it increased the grain and sugar-beet seeds one time and a half. The Kirov state farm of this trust which has similar soil-climatic conditions as the First-of-May Sugar Beet State Farm and which is located nearby harvested 5.2 c/ha of grain, 1.9 c/ha of sugar-beet seeds, and stored the factory sugar-beet for planting, since as a result of the low harvest of mother sugar-beets the storage plan has not been fulfilled. This is not due to lack of resources. On the contrary, this state farm is provided by energetic resources which is much better and the producing program of the spring sowing was lower than at the First-of-May farm.

	First-of-May State Farm	Kirov State Farm
The size of the plowed field	3161	3555
The number of the divisions	4	4
No. of tractors counting in 15 HP	13	17
Horses	59	41
Bullocks (oxen)	66	101
Used plowed land for 1 HP (in ha)	11.7	10.6

It seemed as if under such conditions the manager of Kirov sugar-combine, comrade Krutsev and the chief agronomist, com. Nikolaev should have fulfilled considerably earlier their field work than their neighbor,

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the First-of-May state farm. In reality, the sugar-beet state farm delayed intolerably spring sowing and the production of sugar-beet plants and fulfilled this work one month later than the First-of-May state farm. The Kirov State Farm delayed still more the production of sugar-beet plants and the ploughing of fallows and other field work.

The work of the Tractor Park was organized exceptionally poorly. While at the First-of-May State Farm many tractorists achieved high production, for instance, A. R. Gudemenko at the tractor KHTZ produced 604 ha, the tractorist Dziuba-658 ha, A. S. Litvinovskii-494 ha, A. S. Shapovalov-410 ha, V. S. Shevchenko on the tractor U-2-392 ha; the tractor brigade I. K. Gladneva fulfilled the plan at 184 percent after having worked out with one 15 HP tractor 543 ha of soft plough land; at the Kirov state farm during the last two years only one tractorist I. A. Zhitniak surpassed the norm, after having worked out 398 ha of soft plough land with the tractor of KHTZ.

One of the basic factors in our attempts to obtain high yields is the strict fulfillment of the entire complex, of tractor work. Without early plowing, without early and clean fallows, with the delay of spring field work and of the production of sugar-beets, as we observed it at the Kirov State Farm, we could not even dream of obtaining good crops of grain and of sugar beets. The decisive condition of a successful work of the tractor park is the well-prepared cadres of tractorists, tractor brigadiers and the correct organization of their work.

The Kirov sugar-beet state farm is located 25 km of its Sumsk trust. This is the closest state farm of the trust. We should not doubt that manager of the trust, com. Ponomarenko and the chief agronomist com.

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Kuliavtsev often visited that state farm. And unwillingly the question arises: have they not seen the ugly job of that state farm during the last two years and could not they assist that farm in correcting its work?

We discussed the work of Kirov State Farm and of Sumsk trust at such length because such work during 1946 could be observed also in other trusts and state farms (Kiev, Vinnizkii, L'vov trusts).

At the same time at those very trusts and even sugar beet farms the advanced workers, Stakhanovites, achieved high crops. Over 700 c/ha of sugar beets obtained the field team leader of the Red Army Sugar Combine of the Poltava sugar-beet trust, the hero of Socialist labor, M. I. Geta upon a field of 2 ha, the field team leaders A. Z. Terebillo and A. A. Galanets obtained with their teams a yield of over 600 c/ha. The field team leader of Veselo-Podolianak sugar beet state farm, the hero of Socialist labor, I. G. Gudzenko, obtained a yield of sugar-beets 672 c/ha on a field of 2.7 ha. The team leader of Somovetsk combine of Vinnitsk trust, A. F. Saulko obtained a yield of 580 c/ha sugar beets. Under difficult conditions of Kirovograd oblast', with a complete absence of waterfall, the team leader, comrade Brik obtained 511 c/ha of sugar beets. In the Kiev trust in Sinaiivsk sugar combine the team leaders M. I. Iukianets obtained 535 c/ha of sugar beets, and A. P. Holchan-514 c/ha. A high crops of sugar-beet seeds were obtained by the team leaders of Orkhovek state farm of Poltava sugar beet trust, T. E. Gladkikh, 22 c/ha from a field of 5.5, the team leader of New-Bykovsk sugar combine of Chernigov sugar-beet trust, A. A. Khriapa, 24.6 c/ha from 2 ha, the team leader of Zemetchinsk sugar combine of Pansen oblast', E. Bulycheva, 21 c/ha from 3 ha, and others.

As a rule, the density of planting upon all Stakhanovite fields of

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production sugar-beet was higher than 100 thousand roots per hectare. Comrade M. F. Saulko achieved planting density at the moment of digging-112 thousand tubers per hectare with the average weight of the tuber 530 g. Over 110 thousand tubers were obtained by the team leaders Geta, Calanets, Terebillo.

How did the team leaders Stakhanovites achieved such success?

All of them loosened the soil between the rows as soon as the sprouts appeared, they dug around the sugar-beets at the stage of the two first leaflets at 16 cm deep, after the digging they loosened the soil, after testing they dug again, added at least two feedings-after the digging and after the testing; as feeding they introduced superphosphate 11.5 c, potassium nitrate 2-2.5 c. and 1-1.3 potassium salt. They worked conscientiously applying advanced agricultural technic.

It is superfluous to say that such agricultural technic is accessible to all of our state farms. Every agronomist of sugar-beet farm who is in charge of the division or a brigadier were able to become convinced by the experience of their work that under equal conditions, in the same Soviet farm division or at the brigade field some brigades and teams obtain good results and some-poor results. If, following the example of Gudzenko, Geta, or Saulko, the other teams would work as conscientiously, then they would obtain different results. The study of the leading workers' experience, and mainly its expanding of this experience is the principal task of the leading workers of sugar-beet state farms; it is necessary not only to widely advertise the experience of the Stakhanovites, but also try to apply it in reality.

The February plenum of the Central Committee of VKP(b) required

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from the leaders of party, Soviet, and agricultural institutions a systematic and skilful leadership in agriculture, the elimination of bureaucratic, red-tape methods of management which is usually manifested in giving tasks without their organizational daily assistance and testing in fulfilling the tasks.

We should not forget that sugar-beet state farms, as the bases for advanced agriculture and the nurseries of the best work measures, should exert more and positive influence upon the surrounding collective farms, should show them an example. What kind of an example could be Pervukhin, Nizhne-Tavolzhansk or Sotnikii sugar beet state farms which obtained a harvest of 30-40 c of sugar-beets and 2-3 c of grains from one hectare?

In 1947 the sugar beet state farms possess all the necessary conditions for the fulfillment of the tasks placed by the February plenum of the Central Committee VKP(b). The fall plowing for sugar-beets and spring plants has been fully carried out and even earlier than in the preceding years. The provision of mineral fertilizers in state farms increased, and also the amount of application of local fertilizers. All the premises are utilized for the elimination of drought and for the high yield of all plants in 1947.

The year 1947 should be marked in sugar-beet state farms by increase of agricultural production, by introduction of grass crop rotations, by the improvement of the quality of field work, by wide development of Stakhanovite movement.

In order to obtain high and immune yields of all plants the sugar-beet state farms should successively apply the entire complex of agricul-

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tural technical measures indicated by science and by Stakhanovite practices. Here belong the correct and early tilling of the soil, the application of fertilizers, care for plants and controlling agricultural pests and diseases, early harvest without any losses. Out of this complex, in order to obtain a high yield of sugar-beets, the most decisive are those agricultural measures which ensure a full density in planting which contain not less than 100 thousand roots per one hectare. The examples of Bent, Gudzenko, Zagorul'ko and of other Stakhanovites who harvested at least 110-115 thousand tubers are a good indication that such density is possible.

The density of planting depends not only upon dense sprouts, but in some respects, upon the succeeding tilling, thorough clearance of fields from weeds and pests (sugar-beet weevil, flea, bed-bug). Besides, during the second sprouting (second pair of leaflets) and during the appearance of rosettes it is necessary to pay more attention to the powerful development of the sugar-beets and leave those plants which are best developed, and eliminate those which are weaker. Plants which at the moment of second sprouting are strongly developed will yield during the harvest a heavier tuber. According to data obtained by our experimental stations, the sugar-beet yield obtained by our experimental stations, the sugar-beet yield obtained during second sprouting of large sprouts, in comparison with the yield which has been obtained after leaving small plants surpasses 80 percent. Thus, the quality of the plants which are left in the row during the second sprouting is the basic factor for producing a high sugar-beet yield.

Along with the normal density of standing (one hectare for 100 thousand roots) the leaving of powerful plants during the second sprouting

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and the testing of the rosettes will ensure a considerable increase in crops.

The search for a high yield of sugar beet seeds and their quality should begin with the arranging of best conditions for the yield plantings of best quality. If we will be able to obtain planting of good quality with the average weight not lower than 250-300 g. then we will promote in some degree a high yield of sugar-beet seeds.

In recent years the sprouting of the planting material, due to decline of the agricultural technic of the mother sugar-beet, had been reduced. The root quality also deteriorated. The second sprouting of the mother sugar-beet should occur at a distance of 10-12 cm so that at the moment of harvest the plantation yields at least 140 thousands of roots per one hectare.

During the second sprouting of the mother sugar-beet, it is necessary to strengthen the control of the labor quality. We must keep in mind, that the second sprouting of the mother sugar-beet is decisive for the yield of the planted material, and, if the density of the planting for the production sugar-beet is an important factor for obtaining high crops, then for the sowing of mother sugar beets this significance increases many times.

The significance of an early highly qualified planting in order to obtain high yield of sugar-beet seeds is well known. We should mention here a few measures in nursing transplanted material. One of the peculiarities of the transplanted material is that, in comparison with sugar-beets, the roots do not penetrate deep into the ground. Due to this fact, the transplanted plants use only the moisture of the upper part of the soil (up to 50 cm) and take very little moisture from deeper areas; the leaves of the transplanted

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plants evaporate during one time unit more moisture comparing with the leaves of the sugar beets.

According to the data of Ivanovsk selection station, during the ripening of the transplanted plants 70 percent of the root system (in weight) are spread 0.50 cm in width, and in the depth some roots reach as far as 150 cm; during blooming, when there is a maximal expenditure of moisture, the roots of the transplanted plants reach only 105 cm in depth. The root system of the first year sugar-beets reaches during harvest time 222 cm in depth.

According to the data of Ramonak selection station, the leaves of the transplanted plants during the same length of time lose considerably more moisture than leaves of sugar-beets. For instance, the leaves of transplanted plants lose 10.7 percent moisture in two hours, but the sugar-beet leaves--7.5 percent; after 4 hours the leaves of transplanted plants lose 15.1, and the leaves of sugar-beets--11.1 percent; after six hours the first ones 21.7 percent and the latter 13.8 percent; after 8 hours--26.6 and 17.8 percent; after 22 hours--58.2 and 31.7.

Due to these peculiarities the tilling of the soil is extremely important: the upper layer of the soil should be loose and thus allow the air and waterfall to penetrate into the roots. The loosening of the soil also prevents the growth of weeds and loss of moisture through evaporation. That is why the introduction of double cross loosening of the soil around transplanted plants and constant control of weeds are so important. Sugar-beet state farms are able to carry out at least four double cross loosening of the soil and the necessary weeding. The execution of the rest of agricultural

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technics in nursing transplanted plants (feeding, tying up the bushes) and early harvest without losses will create the necessary conditions for obtaining a high yield of sugar-beet seeds.

It is necessary to mention that the Stakhanovites during their work with sugar-beets paid special attention to the normal density of planting, selection during second sprouting of the stronger plants, and during their work with transplanted plants they paid attention to early loosening of the soil between rows and a most thorough control of weeds.

Of the measures in nursing cereals let us discuss the harrowing of the sowings. It is well known that the Stakhanovites (Efremov, Kovalev) applied in their work a double harrowing of spring wheat. Thus, Efremov harrowed the first time before the sprouting of the plants (with a deep placing of the seeds) and the second harrowing before the appearance of stems. The application of this measure increased the yield of spring wheat up to 5 c/ha. The best time for harrowing spring wheat is the beginning of the appearance of the stems whereby it is necessary to take into consideration the soil condition. It is necessary that the soil would crumble under the harrow and would not produce lumps. The same could be said concerning barley used for beer production. The harrowing after sowing results in even sprouts and, according to the data of the experiments of Rostov-on-the-Don agricultural station, it increased the yield in 2 c/ha.

The most important measure is an early weeding, especially of sowing of spring wheat, barley and millet. During the first stages spring wheat develops very slowly and therefore upon fields covered with weeds it suffered from the weeds considerably. In order to create better conditions for wheat

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it is necessary to begin the weeding as early as possible, as soon as the sprouts are strong. The same could be said for barley and millet. Special attention should be given to the seed fields upon which the carrying out of such simple agricultural technical methods promote considerably the increase of crops.

All these agricultural technical measures were carried out only under the conditions of good labor organization. It is imperative to ensure in the state farms the organization of team work, to register individual labor executed by each member of the team; lack of personal responsibility should not be overlooked and the remuneration should be according to work; there should be socialistic competition between brigades, teams and separate members of the team. It should be mentioned that before the war over 14 thousand Stakhanovites and 16 thousand skilled workers were working in sugar-beet state farms and sugar combines.

Now the wave of the Stakhanovite movement and of Socialist competitions for high Stalin yields in sugar-beets and other plants reaches widely the workers of sugar-beet state farms. The managers of sugar-beet state farms, party and union organizations should advertize this movement and promote its development.

In 1947 the sugar beet state farms should achieve high harvest not only of sugar-beets, but of other plants as well, by introducing progressive agricultural technic, correct organization of labor and of production measures, by promoting socialist competition, by the increase in labor production and the strengthening of labor discipline; this would ensure the execution of the tasks ordained by the plenum of the Central Committee of the All-Union Communist Party for the lift of socialist agriculture.

A.D.V.

September 17, 1951

Golubinskii, I. N.

Transl. 211: Phytoncides

Effect of onion phytoncides on the
Germination of pollen grains.

Priroda 38(3): 67-68. Mar. 1949. 410 P933 RD. September 14, 1951

Translated from the Russian by R. G. Danbo.

At the present time there exists already quite a rich literature about the mortal volatile effect of phytoncides upon microorganisms which were discovered by Prof. B. P. Tokin. As it is well known, the most effective phytoncides are produced by various varieties of onion and garlic.

The research made by Pevgova (1944) indicated that the mortal effect of phytoncides of onion and of garlic could reflect also upon a series of higher plants (water thyme, legume, squash, corn etc.). This indicates the universal effect of phytoncides upon the cells of both higher and lower organisms.

In 1948, before I was familiar with the discovery of Prof. Tokin, I discovered accidentally a strong paralyzing effect of flying fractions of phytoncides of a simple onion upon the sprouting of pollen grains of plants with closed seeds.

In carrying out experiments in producing pollen grains in artificial environment, I obtained a demonstrative confirmation of indications mentioned in botanical literature about the presence of peculiar secrets in pollen grains and in the stigma of pistils which stimulate (or, in some cases, check) the sprouting of the pollen (Golubinskii, 1945-1947).

Widening the experiments in growing pollens, with the intention of bringing closer the conditions of sprouting to normal conditions, I decided to carry out the sprouting in the presence (i.e. in the atmosphere) of the flowers of the same or of another type. For this purpose, at the bottom of a Petri cup upon whose covers were placed drops of growing medium, were placed flowers of corresponding type. The experiments really produced a

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positive effect and the presence of flowers of the same plants as well as of other varieties often stimulated the sprouting of pollen grains accelerating the process, increasing the percentage of sprouts and the length of pollen ^{tubes} ~~grains~~.

Further it was planned to study the effect of volatile substances of fruits and in the first place, of apples, whose influence upon the ripening of other fruits and upon the development of plants has been mentioned in literature. Not having at our disposal any apples, we decided to make the experiments with some vegetables and as the first we used simple onions.

The first experiment in germination of the pollen in the Petri cups over the circles of onion bulbs which were cut across gave such unexpected results that they immediately attracted our attention. Really, the pollen of a series of plants sown upon freshly cut onion refused to sprout, while simultaneously it germinated well in control cups. Repetitive attempts of germinating the pollens and including into the experiments the pollens of new varieties of plants gave the same results.

During this experiment ^{it} has been determined that the presence of the pollen sown upon the nourishing parts of the cut onion not only checks the sprouting pollen grains, but kills them entirely, since the transfer of the pollen into fresh air, after having been five minutes in the atmosphere of phytoncides of onions did not save the pollen grains and they lost their ability to sprout forever.

It is characteristic, nevertheless, that the phytoncides of onion kill the pollen only after its sowing upon the nourishing parts for sprouting. The Phytoncides do not affect the dry pollen (at least during the effect of

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24 hours with triple onion shift). The pollen of any of plants under experiment (about 15 varieties) after having been in dry conditions during twenty four hours in an atmosphere saturated by the phytoncides of onion and sown later for sprouting sprouted normally.

The mortal effect upon the sprouting pollen is indicated only by a freshly cut onion. When we sow the pollen upon an onion which has been cut half an hour ago they sprout normally.

Whole onion bulbs which were not cleaned from their external scale manifest a peculiar effect upon the growing pollen. A few, small bulbs were placed into a cylinder, ^{in size} at the size of about 150 cm. In order to create in the cylinder a humid atmosphere, some water has been poured into the bottom. The cylinder has been covered by a glass plate into whose interior some drops of the nourishing medium with the sown pollen were introduced. The task of this experiment was the study of the influence of whole, uncleaned bulbs upon the sprouting of pollen grains. It has been clarified that in this case, although the pollen grew somewhat normally, the thickness of the tubiflorae was inferior to the control one. Besides, in this case the medium and the tubiflorae somehow conserved, remaining unchanged up to six-eight days (under the temperature of 20 percent). It is quite characteristic that neither in this case, nor with the sowing over the cut onion was it possible to observe fungi mycelia which were developing strongly in sugar solutions which serve as nourishing substrate for the sprouting of pollen grains.

Especially powerful effect of phytoncides upon the sprouting pollen tubiflorae is derived from the onion juice, whose minimal mixture hampers

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their sprouting.

The testing of the phytoncide effect of other plant varieties had confirmed the data of Prof. Tokin and of his assistants. Like other experiments with microorganisms, the phytoncides of other plants affect the pollen less than the onion phytoncides.

A.D.V.

September 14, 1951

Puzikov, D. N.
Variety breeding and seed production of sugar
beets during the Soviet period. Sakh. Promysh.
20(11): 43-46. Nov. 1947. 65.8 Sa2.

Transl. 212: Sugar Beets

SB-157

Translated from the Russian by R. Dembo

There was no sugar beet seed breeding in pre-revolutionary Russia. In this respect the sugar industry was at that time depending upon foreign seed breeding firms. Concealing their methods of selection, organizing cleverly seed trade, the foreign seed producing firms, especially German, acquired monopoly upon the Russian seed market.

Tremendous expenses, required for a serious organization of selection work, failures which are inevitable during the first stages of selection, and unsuccessful experiments at our own selection laboratories which were organized at our sugar factories, all this frightened the Russian sugar manufacturers of selection work. Some individual selection stations and seed producing farms existed in a poorly manner and were unable to compete with foreign firms.

After the Great October Revolution the situation along these lines changes considerably. Even during the Civil War the USSR started the establishment of its own selection-seed producing station. In 1920 the private selection stations and seed growing farms were nationalized. In 1922 was established the selection - seed growing Department of Main Sugar; the scientific-research selection institute was organized.

The inheritance acquired by Main Sugar was not rich. The majority of selection stations and of seed producing farms had been destroyed: selection archives were taken away or destroyed, the laboratory, living quarters and offices were burnt down or devastated. Qualified personnel of selectioners which consisted mainly of Poles left for Poland. The seed fund also decreased drastically. It was necessary to start the selection and seed growing anew.

The first stage was the collection of the most valuable variety material which existed in the country. It was necessary to restore the work of the best selection and seed-growing stations which were active before the Revolution. This task has been fulfilled successfully in quite a short period.

In 1922 already were working 16 stations: Uladovskaya, Verkhniacheskaya, Belotserkovskaya, Udycheskaya, Il'inet'skaya, Sitkovetskaya, Kemerovskaya, Kalininskaya, Ialtushkovskaya, Bironovskaya, Ivanovskaya, Khar'kovskaya, Perezotochskaya, Khoroshkovskaya and Tetkinskaya. This year the Kamonsk selection station has been added and newly organized for the assistance of sugar-beet seed sowing of Voronezh, Tambov and Pensen oblasts.

A summary of the first steps of Soviet Selection stations was made in 1923 and in 1924. Variety testing which was carried out in 1923 in 19 parts of the Ukrainian SSR and in central black-soil oblasts evaluated the entire variety fund of sugar-beet seeds which was available in Russia. Twenty-seven varieties of national selection which were produced upon 14 selection stations and five foreign varieties were tested.

The tests proved hopeful results: the national varieties occupied ten first places on sugar beets from one hectare. According to saccharinity, the national varieties also indicated good results, although the first place was occupied by ultra-saccharine variety of the Polish firm Janash.

In the foreign testing of Soviet varieties was outstanding Udychsk variety which occupied in Halle (Germany) the second place on the composition of the sugar and the sixth on the collection of sugar. In all of these tests not a single German variety had such high productivity with the high saccharinity (18 percent) of the Soviet varieties.

The variety testing made in 1924 confirmed the evaluation of 1923.

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Based upon these variety testings it was possible to come to the conclusion that there are in the country good selection material and that the best of them were collected.

The distribution of selection stations in the form as it existed before the revolution did not correspond to the planned distribution of sugar-beet seed breeding and to the tasks of producing varieties which are best adapted to the soil-climatic conditions of the most important zones of sugar-beet sowing. Therefore, a network of selection stations was inspected. Udychsk, Sitkovetsk, Kal'nikskaia, Il'inetskaia, Beresotochskaia, Khoroshkovskaia stations were closed, and their material has been transferred to other stations. New stations are erected: Ramonskaia in Poltava oblast', Veselo-Podolianskaia in Poltava oblast'. Then in Kursk oblast' was erected L'govskaia station which acquired the material from Tetkinsk station, and the station of the First-of-May for the service of sugar beet sowing in Yrassnodarsk krai. The reorganization of the network was accomplished by the erection of Tiiskaia selection station for the service of sugar-beet sowing in Altai krai, and Frunzen selection locality for the service of irrigated sugar-beet sowing in Kazakhsk and Kirgiz SSK.

Simultaneously with the reorganization of the network of selection stations they are provided with a modern laboratory equipment, new laboratory, living quarters and service buildings are erected - elevators, nurseries, vegetation houses, electrostations, shops. All selection stations are provided with tractors, living tracting power, with new agricultural machines, inventories, mineral fertilizers, agrarian massives are regulated; correct crop rotations are introduced. The Soviet government invests tremendous capital into the construction of selection stations.

The experience on selection of sugar -beets accumulated during five years of work (1920-1925) indicated that by selection of sugar beet tubers, according only to their saccharinity and to the weight of the tubers, it is difficult to achieve any progress in selection work with sugar beets. Therefore, the Soviet selectioners began to base their work upon a complex, all-sided study of sugar beets as a living organism. It was necessary to produce sugar beets the most adaptable to the conditions of specific zones. They had to differ by high yield capacity and saccharinity by small percentage of nitrogen, speedy growth, small content of mineral non-sugars, by a high juice percentage, immunity to fungi and bacterial diseases in the process of growth and during storage by non-blooming.

For the solution of these problems were encouraged selectioners, biological chemists, physiologists, agricultural chemists, field producers, microbiologists, phytopathologists, entomologists, agrophysicists, matematicians and other specialists. Each station transforms into a huge experimental-selection institution which includes, besides the selection division, a series of other laboratories and divisions.

The scientific-research institute of selection is reorganized into an All-Union scientific-research Institute of sugar-beets. The numerous laboratories: microbiological, agrochemical research, study soil and meteorological conditions of the raions of sugar growing, work out the methods of field experiments, execute methodical guidance of scientific-research work of the experimental-selection stations.

The network of variety breeding fields and of experimental points which embrace all the zones of sugar sowing is strengthened and improved.

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The best qualified personnel is attracted to selection-research work in the institute, at stations, variety fields and experimental points; the best personnel is selected among the youth who graduated from higher educational institutions; the preparation and the perfection of personnel is organized.

Simultaneously with the organization of material basis for selection work and the preparation of personnel of numerous specialists-selectioners, work in organizing seed producing farms is widely carried out. Two hundred model seed breeding sugar beet Soviet farms were newly restored. These farms produce yearly 500-600 thousand highly qualified seeds of sugar beets.

A network of seed factories and seed bases is created. Equipped according to the latest technic, the seed factories along with their seed bases were able to produce and to store such great amounts of sugar-beet seeds that it was able to provide for the demand of the entire country for a year.

As a result of measures adapted by Main Sugar, the sugar industry of USSR fully freed itself from foreign dependence. The variety composition of sugar beets had changed.

Replacing the foreign varieties which were dominating in Tsarist Russia, now appeared new varieties of sugar beets of national selection stations produced by Soviet people.

Already during its infancy (1923-1930) the Soviet selection produced a series of first class sugar beet varieties (as far as productivity is concerned) which excels the varieties of foreign selection in sugar production.

The practice indicated that the seeds of the best Soviet selection is capable for better yield than foreign varieties. At the first place, according to the amount of yield from hectar, stands the variety of the Charkov station; the second place is occupied by the variety of Ramonsk station, but according

to the saccharinity it is 0.2 percent higher than the Khar'kov variety and is the best in sugar content of all crop varieties. The varieties of L'govskii, Ivanovskii, Uladovskoi, Telotserkovskoi and Il'inetskoi stations indicated high productivity.

The shift from sugar seeds to the application of crop varieties in USSR which has been carried out in 1924-1925, yields to our national economy 2-2.5 percent of additional sugar from each hectare of sugar-beet planting.

The foreign crop varieties Tippe, Kleinbantsleben, Goerning, Thruube are considerably inferior to Soviet crop varieties according to the yield of sugar from hectare and are not superior in saccharinity.

Experiments which were carried out in Germany, Poland, USA, during recent years proved the high productivity of Soviet varieties of sugar-beets.

A tremendous work in creating a network of Soviet selection stations, seed factories and bases and in providing them with advanced technic has been carried out in the years of the First Stalin Five-Year Plan.

This was a genuine revolutionary reconstruction of variety-seed production in the field of sugar-beets. Not a single capitalist country possesses such a powerful variety-seed producing system as we possess in our sugar industry.

The sugar industry of Tsarist Russia during the 116 years of its existence was able to obtain sugar-beet seeds of national selection only 1/4 of its requirement.

The Soviet sugar industry in the first ten years of its existence already produced all the necessary amount of highly qualified selection seeds of national origin.

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In comparing these two historical factors, the advantage of the socialist system of national economy over the capitalist system is obvious.

During the years of the Second Stalin Five-Year-Plan the Soviet selectors and seed-breeders started with the execution of a new great task: to produce such sugar-beet varieties which could be adapted to the soil-climatic and productive conditions of the most important zones of sugar-beet seeds in USSR.

In order to adapt these varieties into the most remote places with most variable conditions of climate, soil, agricultural technic, the capitalist seed firms produced a theory of cosmopolitanism of sugar-beet variety, i.e. equal validity of the variety disregarding the locality of its production. This theory was well founded as long as the imported sugar-beet seeds were superior to those sugar-beet seeds of the country which imported them.

But we know since Darwin's time very well that all organisms change under the influence of the environment. The Soviet selectors and seed-breeders who were guided by the progressive theory of Darwin did not accept the anti-Darwin theory of cosmopolitanism.

The improvement of methods of selection-seed producing work and accumulation of material in variety-testing assisted in producing various evaluation of the same varieties in different zones of sugar-beet planting already in the middle of the first Five-Year-Plan. This fact became more obvious in spite of complicated conditions caused by the fluctuating meteorological conditions.

This caused the production of varieties according to their indexes in those zones of sugar-beet seeds where they are prepared for sowing instead of general evaluation of the varieties along the entire network.

Of largest theoretical and productive significance was the production of a series of first class varieties which preserved their valuable qualities not only in the first, but in a series of succeeding generations. Such first variety was I 1305 which had been produced upon Ivanovsk station. Formed in 1930 from a series of competing and individual selection numbers, this variety, after propagation in 1931 and 1932 has been for the first time included into variety testing in 1933 and obtained perfect evaluation in a great number of sugar-beet zones according to its high sugar yield.

The variety of Verkhniachesk station V1025 of normal direction, the crop varieties of Uladov station - U 1030, L'govsk L 1057 and L 1053, of Ivanov station - I 1006 which were under experiment in 1935 yielded high sugar crops in a series of zones of sugar-beet planting. The first and the second generations of the indicated varieties preserve their valuable qualities in the zones of temperate climate (?) in 1938-1941. The testing of the third and fourth generations in 1945-1946 indicate the considerable productive value of these varieties within a more limited number of zones of sugar-beet growing where they continue to appear.

- The varieties: from Ramon selection station - P 1537, from Ivanov I 1531, L'gov - L 1535, Melotserkovsk - PTS 1551 and others which were produced in 1936--distinguish themselves by a high generative immunity.

The fact of generative immunity of a series of perfect Soviet varieties is a great event in the field of selection of sugar beets. It signified the birth of sugar beet variety as such.

The sugar beet variety production of the best seed enterprises of the capitalist countries did not know and does not know reliable, generative

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immune varieties of sugar beets. In the best case these firms have selection materials which preserve their value only in the first generation.

The success achieved in producing generative immune selection materials placed upon a firm basis the problem of producing such sugar beet varieties which are best adaptable to the conditions of the main zones.

At the present time a series of zones of sugar beet planting which embrace over 50 percent of all sugar beet sowings in the country has already high productive varieties which are adaptable to local conditions. The other zones also have good varieties. Nevertheless, considerable fluctuations of these varieties according to various years indicate the insufficiency in their adaptability to local conditions.

The best raion varieties are those produced by selectioner A. L. Lazumov at the Ramon station - P 1537 and P 306. These varieties yield in the Voronezh and Tambov zones of sugar-beet growing an increase of 6-8 percent of sugar.

The Ivanov station provided its sugar-beet growing zone (Sumsk, Khar'kov oblasts and the Southern part of Poltav oblast') with good raion varieties I 1745, I 1531, I 1305. These varieties provide the increase of sugar at 5-8 percent in their zone.

The Uladov station produced high productive varieties U 1030, U 1555 which yield 5-6 percent more sugar in its zone (Zhitomir oblast and the Northern part of Kamenets-Podol'sk and Vinnits oblasts).

L'gov, Belotserkovsk, Verkhniachesk stations produced a series of raion varieties.

One of the greatest achievements of Soviet selectioners is the elimination of the yearly crop rotation. But in capitalist countries they are still

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using in sugar beet production only the seeds of the first generation of the seed elite which are substituted by new selection seeds.

The production of high productive, generative immune varieties which are adapted to the conditions of concrete sugar-beet zones in USSR permitted the majority of raions to shift to sugar beet sowings of the same varieties for a series of years.

The basic problem of selection seed producing work is for the near future the provision of all sugar beet zones of our country with productive varieties of sugar beets which combine high yield with high saccharinity.

The cultivation of non blooming varieties for all raions of sugar-beet sowing where the sugar beet blooming is noticeable is quite important.

The cultivation of ultra-saccharinity varieties of sugar-beets is of great interest for the selection work and for productive sowing of a series of raions.

A speedy solution of these problems will lift still higher the authority of Soviet selection and Soviet seed production.

End of article

L.A.B.
9-18-51

Pecofilaktov, V. V.

Transl. 213: Growth Substances

Root-forming growth substances. Mokkov. Ordena
Lenina Sel'skokhoz. Akad. in. F. A. Timiriazeva.
Trud. 30:173-182. 1945. 106 1352T

The author is the head of the Department of Inorganic and analytical chemistry

Translated from the Russian by H. Dembo

Endocrinology, the science of the inner secretion of animal glands,
which became an independent science based, mainly, upon the work of Brown-
Sekara (1889), discovered the study of hormones (Starling, 1905).

Hormones along with enzymes, vitamins and inductors (organizers), in the
contrary to energoplastic substances (albumen, carbohydrates, fats, lipoids)
are presented in the organism in small quantities and, manifesting its oligo-
dynamic effect, provide a normal development and a normal life activity of
the organism.

The chemical nature of the animal hormones has been determined in a
of cases. The chemical synthesis of some of them--thyroxine and adrenalin
(the over kidney gland) and some representatives of the group of sexual hor-
mones--has been realized which fact permitted to use these synthetic compounds
for serving medicine and husbandry.

The study of analogical substances has started in the vegetative world
somewhat later. Already Darwin, who discovered (1880) the phenomenon of the
transfer, from a distance, of geotropical and phototropical irritation,
expressed the assumption of the presence of some substances at the top of the
vegetative organ (root, stem) which spread along the organ and transmit the
irritation there.

Later on, Sachs (1887), "Pelerink" (1888) expressed the idea of chemical
regulation of morphogenetic processes in plants which obtained later the devel-
opment in the work of "Error" (1905) and "Fitting."

Further works of the individual botanists who tried to apply the ideas of endocrinology in explaining some of the life phenomena of vegetative organism (Neliubov, 1914; Dz. Leb, 1917), and also fundamental research of Kholodnyi (1918), Haberland (1913, 1925), introduce us into the contemporary period of the development of vegetative hormones--phytohormones or growing substances.

In order to explain the plant's reaction upon the mechanical damage (wound), in order to explain the phenomena of tropisms (geo-photo-electrotropisms) in order to explain various morphogenetic effects of the explorer, the existence of special material factors has been assumed.

Thus, Haberlandt admits the existence of wound hormones ("necrohormone", "Traumatine"). Stark, Grendmann--tropism hormones ("trophohormones"). Vent and others--hormones of morphogenesis or "kalina": "rizokalin" which forms roots, "Kaulokalin" which forms stems, "Karpokalin" which forms fruits, phyllokaline which assists in leaf development; as factors which determine blooming are considered phlorigen (Chailakhian), "vernaline" or "anthesine", "antogenes" of other authors; in sprouting cereals was assumed (Kholodnyi) the presence of "blastanine".

The chemical basis for this idea was furnished by the work of Kegel (1935) who explained the chemical nature and composition of the sprouting substance--auxine "a" and "b" and hetero-auxine, which are widely spread in plants in small quantities and which are contained in quite considerable quantities in the urine (of man) from where they were at first developed, and auxines ("a" and "b") are still derived.

The number of such compounds has increased after the discovery of "bios" ("Vild'e", 1901) which is so important for the development of lower plants

(yeasts), the disclosing of its complicated nature (Fiul'mer", 1923), the fixing of its main parts: "mezoinozit"-- $C_6H_{12}O_6$ (Eastcott, 1927), aneirine (thiamine, vitamin B₁) (Williams),--compounds known previously, and biotine-- $C_{11}H_{18}O_5H_2S$ (Kegl', 1932)*; and finally, pantoten acid-- $C_9H_{17}NO_5$ (Williams). These data assist the chemical method in proceeding with the study of phyto-hormonal phenomena.

*According to the latest discoveries of American authors-- V. du Vigneau and coworkers--biotine has the compound $C_{10}H_{16}O_5H_2S$ (see below).

The conception of some explorers (Kholodnyi and others), which is based upon the "physiological polyvalence" of these substances--auxine, heteroauxine and also their non-specification and which is of less pluralistic character, is quite deceiving. Thus, the increased concentration of auxine in the fields of coleoptile accelerates the growth of these parts, but delays the growth in the root tissues; the solution of heteroauxine in connection with the concentration affects the root growth either in retarding or accelerating fashion; it became clear that heteroauxine has the capacity of causing acceleration or retarding of the cell growth in their length, with other plants it stimulates the cell division which may cause specific morphogenetic effect--root formation, thickening of the stem or of the root, etc., or the transformation in the form of the developing leaves. It became evident that the root requires, evidently, for the geotropical reaction, the same substance which is the growth regulator and which determines the phototropical and geotropical bendings of coleoptile and of other plant organs which are above the ground. On the other hand, this substance is not specific: the tops of corn coleoptiles which were planted upon beheaded roots of blue lupine caused distinctive geotropical bendings.

The polyvalent character of these firmly determined growing substances in their combinations or in various concentrations explains many phenomena of tropisms and morphogenesis, without going beyond real facts, and this will cut the list of various "kalins", tropohormones", "phlorigenes", etc.

As the cause which produces the inequality of concentrations of growing substances in individual parts of the plant organ which are influenced by tropisms we must consider the physiological polarization of tissues which sums up to "electrical polarity", i.e. the presence of a definite differentiation of potentials between the sides of the organs which are variably oriented (Kholodnyi, 1929).

Thus, Brauner (1930) discovered a so-called "geo-electrical effect"--the presence of an electrical gradient in plant along the vertical line (the increase of the potential downwards).

The photopolarization of tissues under one-sided light is expressed, according to Kholodnyi (1927), Waller, Brauner (1927), also in the creation of potential differentiation--the illuminated side becomes electro-negative in relation to the non-illuminated one.

It has been known for a long time that the struck spot becomes electro-negative in relation to the neighboring non-struck fields; some increase of the positive charge of the cells which are located directly under the surface of the wound should correspond to this factor.

Auxine, and evidently, heteroauxine also, according to the data given by Vent and Kholodnyi, move along the living vegetative tissues in the direction of the growing potential (anion). This explains the change of auxine concentration and the tropism phenomena, (geo-photo-electro-) and wound phenomena which are produced by it.

The academic Kholodnyi thus formulates the real position of this problem: "Out of the chaos of factual material, gradually stand out clear contours of a theory which promises in the near future to unite the multitude of the most varied experimental data based upon one principle and to bring them all into definite order."

Such is the position of the phytohormone problem in general terms.

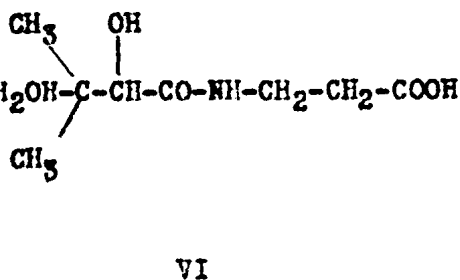
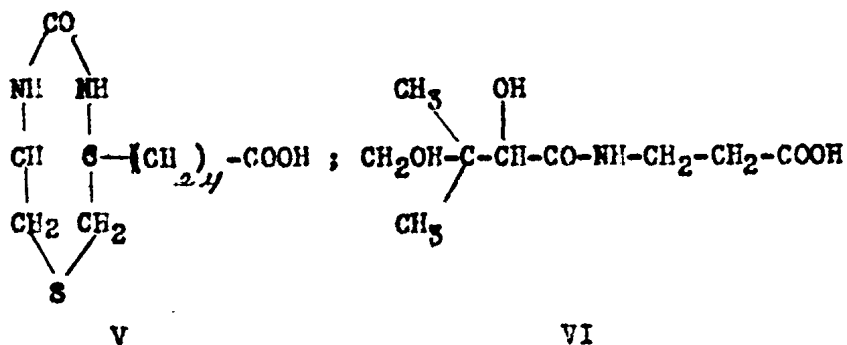
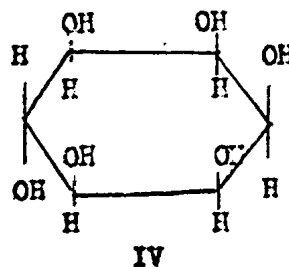
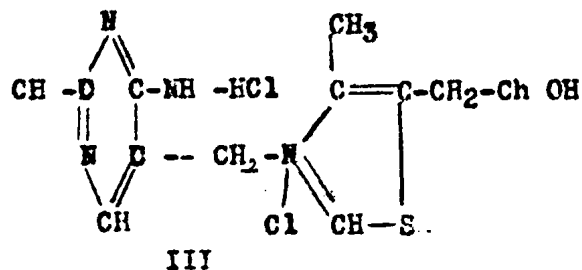
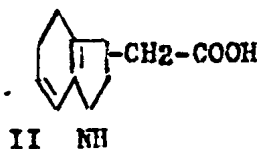
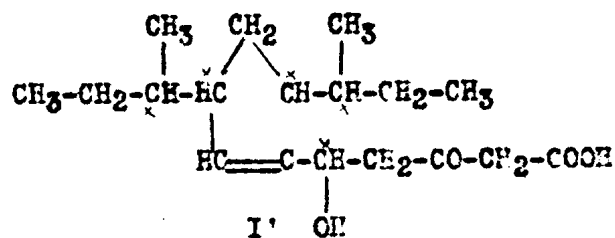
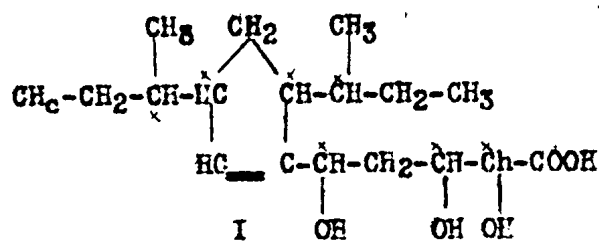
As soon as the phytohormones became accessible, some of them obtained practical application. Indolyl-acetic acid was known to the chemists before its role as a phytohormone has been determined. The chemists also knew the methods of acquiring it synthetically. And this substance has been practically applied first by grafting of various wood species and in applying to various species with which we were unable to produce root formation by the well-known methods.

The summary of the foreign and of our national experiment was given in a pamphlet of M. Kh. Chailakhian and R. Kh. Turetskaia which was published in 1942 under the editorship of N. A. Maksimov who worked a great deal in this field.

Due to a tremendous interest in such substances and also due to their small amount in plants, where their presence is manifested by special extremely sensitive biological methods, and due to the practical impossibility of acquiring them by utilizing vegetative material, the question arose concerning their chemical synthetical acquisition, at least of some of them.

Let us recall that, in order to obtain auxin ("a" and "b"), up to now, urine has been used as the basic material separating from it hormones with great difficulties.

Out of the mentioned phyto-hormones there is a specific composition for auxin "a" (I), auxin "B" (I¹) heteroauxin (II) vitamin B₁ (III), "mezoinozit" (IV), construction of biotin according to exploration of V. du Vigneaud, K. Hofmann and D. Melvill (1942) is expressed by the formula V, the texture of pantomorphic acid by the formula VI:



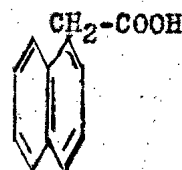
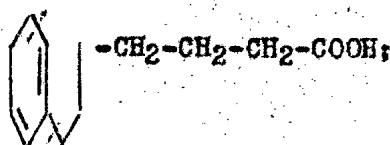
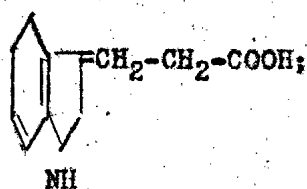
The attempts for a synthesis of the auxin "a" and "b" are unable to
 •
 promise good results, taking into consideration ^{that} the presence in the molecule I-
 of seven, and in molecule I¹--of five asymmetric carbon atoms enables the for-
 mation of the compound I 2⁷ = 128 stereoisomers whose division, aiming to iso-
 late physiologically active isomers, became a problem almost hopeless.

Heteroauxin (indolyl-acidic acid) has been synthesized before; now its
 syntheses are considerably improved (Maima, Khoshino) (V. 58, 2037, 1925).

The organic chemists tried experiments with phytohormonal effect and
 with some other substances which are analogs or homologs of heteroauxin, since
 in animal physiology the fact has been determined that not only the compound
 which has been discovered in animals possess some physiological effect, but
 often the homologs and analogs of the given substance, for instance, in the
 group of sexual hormones--and/or osteron, eistron, in vitamins--B, D₁ and some
 of his analogs, K₁ and metilaphtoquinon and others, as well

Physiologically active are the following analogs of heteroauxin:

β -indolylpropiin, β -indolyloil, π -naphtyl-acidic acid.

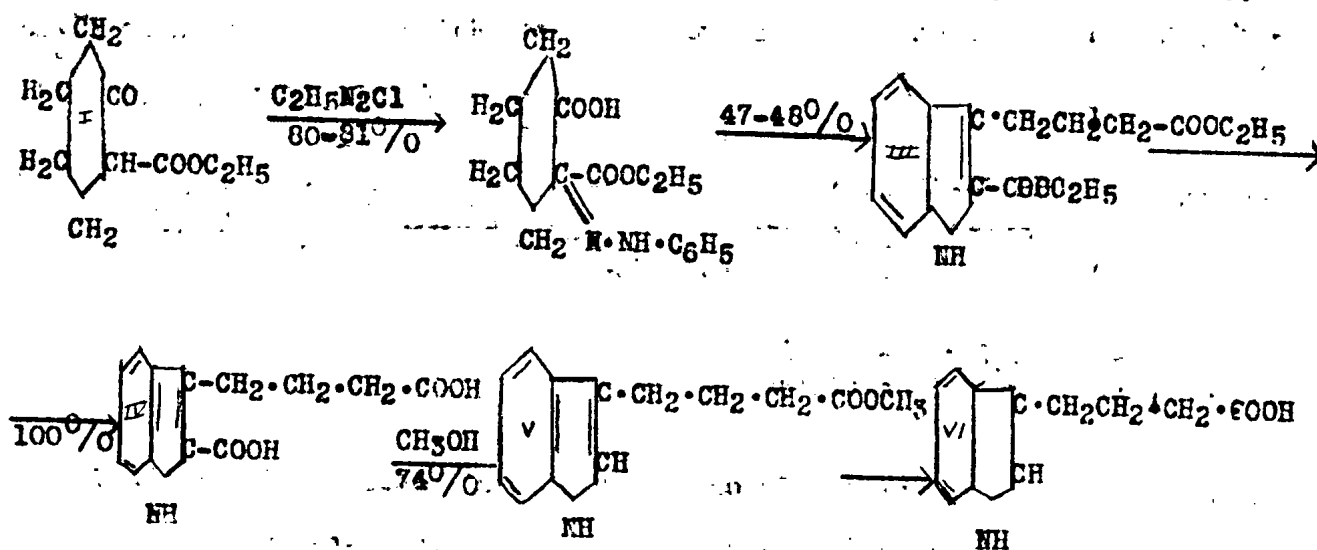


These compounds were utilized in practice of plant production. These
 substances, not being phytohormones in real sense, but being their substitutes,
 according to their effect, in some cases surpass natural hormones. Thus, for
 instance, the indolyl oil acid which has not been disclosed in plants sur-
 passes several times (some times 16 times and more) heteroauxin in its effect

for root forming and therefore represents a special interest. The application of this substance assists in producing a good development of the root system in such plants which either are unable to propagate by grafting (coniferous needle trees, the majority of citrus trees, some fruit plants), or with such plants with which the grafting inculcates slowly and insecurely (gooseberry, quinine tree and others).

Therefore, the simplification of measures of synthetic acquisition of indolyl oil acid, in order to use it for various branches in plant growing, represents a task of great importance.

Literature indicates two methods of obtaining it. Jackson and Manske (J. Am. Soc., 1930, 5029) realized this synthesis according to the scheme:

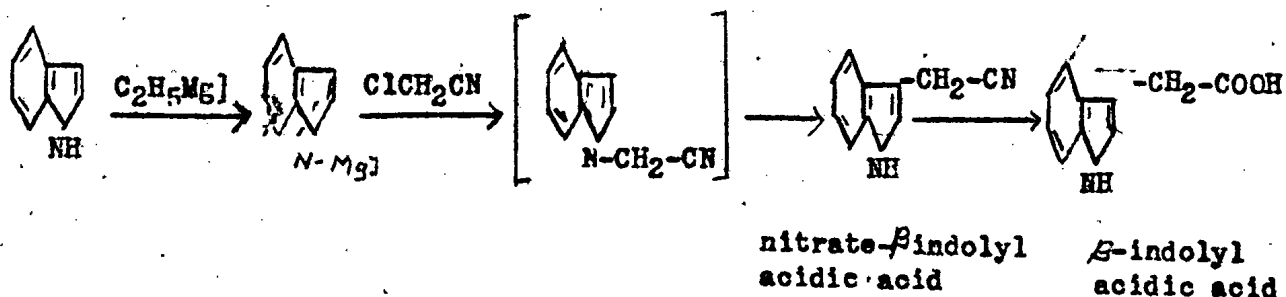


As it is shown, stage I-II is quite satisfactory (80-81 percent), but stage II-III (the locking of the indolyl ring) yields an unsatisfactory result: after cleaning by distillation in a vacuum (7mm. under 235°) the outcome is 47-48 percent of the theoretical.

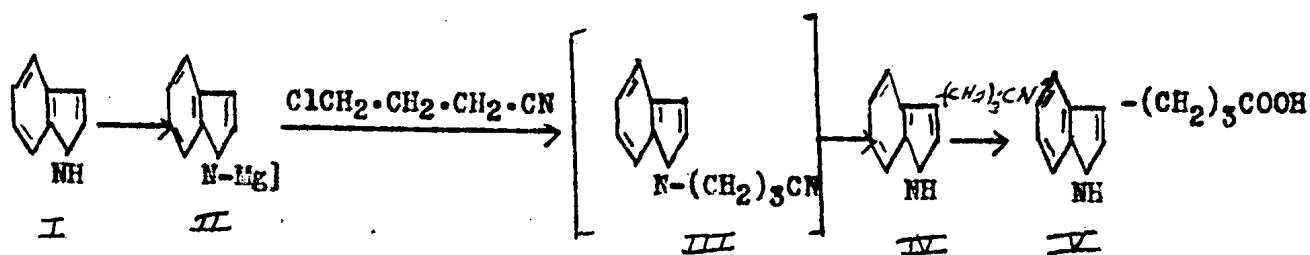
After having obtained dicarboxylic acid (IV), after decarboxyding, the authors transfer it into methyl ether (V), destillate it in a vacuum (230°,

6 mm) obtaining 74 percent of the theoretical, because, according to their experiments, a direct decarboxilling (IV-VI) yields a product (VI) which is hardly cleaned. The saponification of methyl ether (V) into indolyl oil acid yields (VI), according to the authors, the necessary acid, which is cleaned with difficulty and which melts under 124° ; the outcome of this stage (V-VI) is not indicated.

In 1941, the academics²⁴⁵ S. S. Nametkin, N. A. Dzbanovskii and A. G. Rudnev (DAN USSR, 1941, volume XXXII, page 333), in observing the considerable complexity of the above indicated synthesis of the American chemists which up to the recent time is considered the only method of obtaining indolyl oil acid, described their method of obtaining it based upon the synthetic method β of indolyl acid α acid which were given by Japanese explorers Maime and Khoshimo (v. 58, 2037, 1925).



Utilizing this method in obtaining indolyl acid α acid, according to the scheme indicated below, S. S. Nametkin and his assistants applied it successfully to the synthesis β of indolyl oil acid by replacing nitrile of chloride acid α acid by nitrile γ of chloride oil acid:



The stage of obtaining magnesium-iodine-indole from indole and from magnesium-iodine-ethyl (I→II) as well as the interaction of magnesium-iodine-indole with nitril γ of chloride-oil acid (II→III), is realized in the sphere of anisole; nitril (IV) which was obtained after the analysis of the compound (III) has been cleaned by distillation in the vacuum (2 mm, 210-215°), 36.2-36.5 percent of the theoretical escaped. Its saponification yielded the necessary indolyl oil acid (V) with the escape of 83.5 percent of the theoretical after cleaning which melts under 124°.

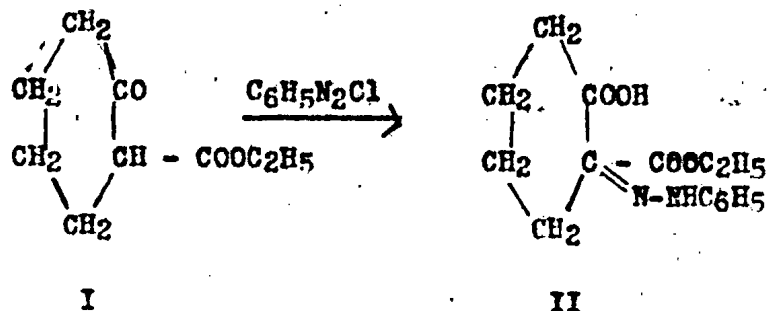
Not a single of the described measures promise the formation of indolyl oil acid by an accessible compound in the form as it is given.

The measure of Jackson and Manske, although it is formed by cyclohexene-carbonaceous ether and aniline, yet it yielded to the authors not high discharge; in some stages the cleaning of temporary products through distillation in a vacuum (III and V) is required; this method includes five stages.

The method of the academic Nametkin, although it includes less stages (only three), but yields also a low escape (discharge?) (36.2 percent; 83.5 percent), requires vacuum distillations (IV), the main thing, is the complicated accessibility of the initial substances: indolyl has been hardly accessible until recently and will not be for some time an accessible substance, nitril γ of chloride oil acid (which is obtained according to the scheme: glycerin, allyl alcohol, chloride allyl, chloride bromide trimethyl, nitril γ of chloride oil acid) is not easily accessible and requires the

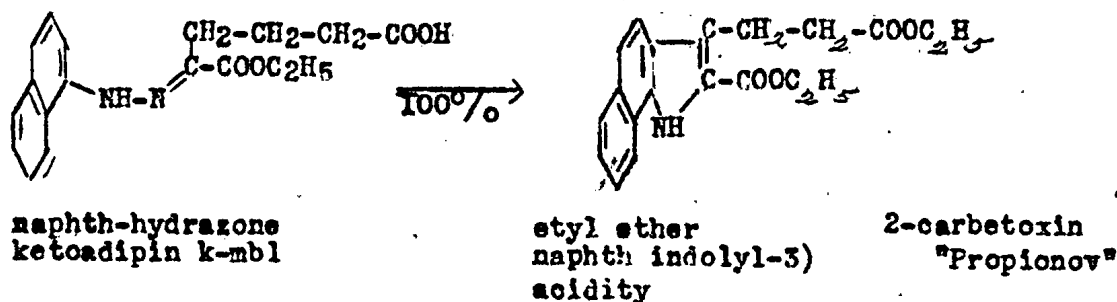
application of KSI at the last stage: the reaction of magnesium-iodine-indolyl with nitril requires iodine ethyl and anisole.

With systematic research of reactions of aromatic diazo compounds with alkyl acetic acideic ethers, whose results were published before (see "Izv. Akad. Nauk USSR", department of chemical science, 1941, page 521), A. A. Ivanov and myself studied the first stage of reactions:



The escape of the Product II appeared to yield 95-98^{with} percent of the theoretical under repeated experiments, i. e. it was more than ^{with} American explorers (80-81 percent), and, besides, this substance has been obtained in two stereoisometric forms which has not been observed by American explorers.

Besides, by studying the capacity of aryl-hydrazones in looking into indolyl derivatives under the appropriate regime of the reaction the following scheme could be obtained with a qualitative escape (see the following information):

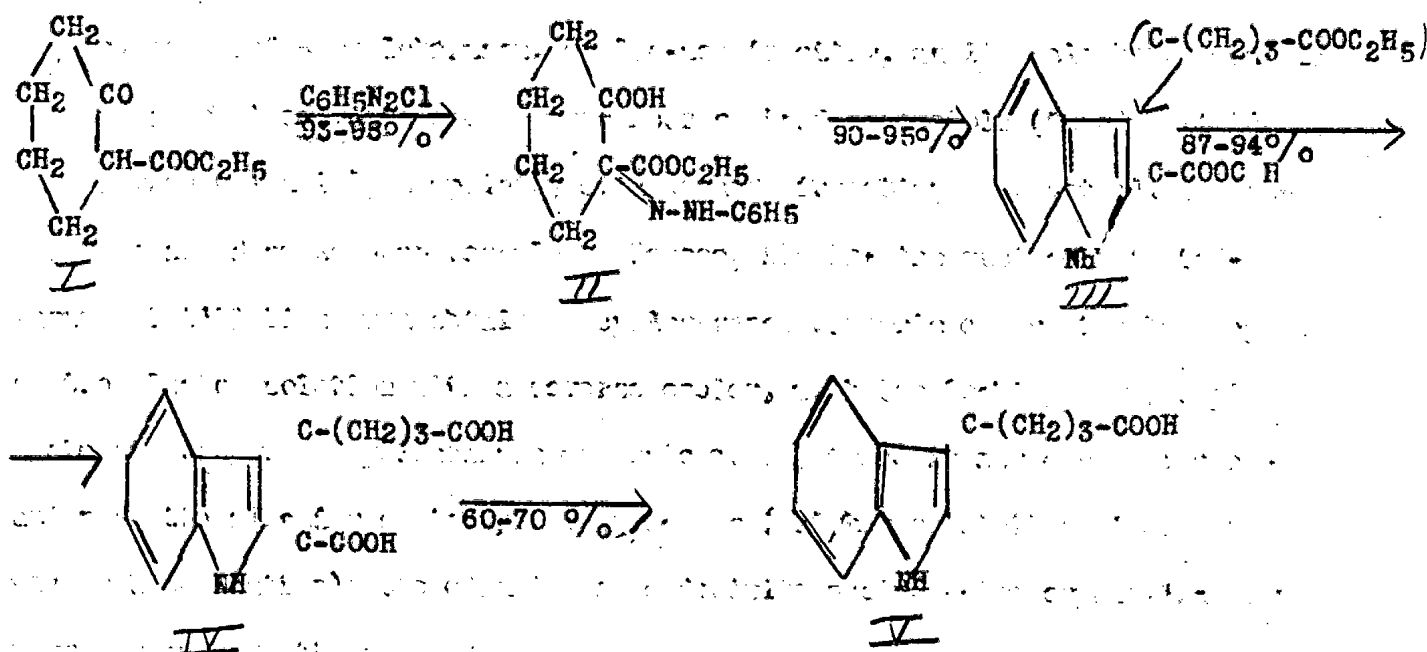


This indicates that the escape indicated in the article of Jackson and Manske even at the stage (II--III) at 45-48 percent are not maximal and could be increased.

Besides, the distillation in the vacuum which has been described by these scientists as substances necessary for the cleaning of substances, according to our estimation, were not absolutely necessary.

Based upon the experiment of Jackson and Manske on various stages of the synthesis and also realizing the critical remarks expressed above, I worked out the following scheme of the synthesis (see the formula on page 180).

Cyclo-hexanon carbon containing ether (I), which is obtained from cyclohexanon (the preparation is as follows: phenol--cyclohexanol--cyclohexanon) and from oxalic-ethyl ether, is combined with chloride diazobenzol (from anilin and sodium nitrite) in alcohol-water medium in an open glass vessel at the cooling up to $+1--5^{\circ}$.



Phenylhydrazon of acidio ether (II) escapes in the form of orange-yellow crystalline product (mixture a- and b- forms). Escape 93-98 percent. Without any cleaning, by boiling it for several hours in an alcoholic solution of sulphuric acid and by pouring it into freezing water, we obtain ether (III) with an escape of 90-95 percent of the theoretical, the temperature of melting is 76° ; its saponification with alcoholic solution KOH under cold temperature, without any preliminary cleaning, yields quantitatively K-sodium chloride of dicarbonated acid (IV), the acidity of K-sodium chloride yields a loose dicarbonated acid with the escape of 87-94 percent of theoretical; this acidity without any cleaning, yields, by heating on oil bath, decarbo-oxidizing, the expected indolyl-oil-acid (V) with the escape of 60-70 percent of theoretical, and only in this stage a cleaning is required--one-or double crystallization from water (with the addition of carbon) yields a clear indolyl oil acid (temperature for melting is 124°).

The advantages of the worked out method are: the accessibility of the initial materials--cyclohexanon, oxalic-acidic ether, anilin, alcohol, metallic sodium; among them there are no poisonous or hard accessible (indol, nitril, γ -chloride oil acid), simplicity of apparatus formation: almost all the operations are done in open vessels: glasses, flasks: the most complicated--vacuum distillation when obtaining cyclohexanon carbonic ether, the boiling of the alcohol solution with a reverse cooler, with the locking of indolyl cycle starting with cyclohexanon-carbonic ether, there is not a single operation of the cleaning of temporary products (neither crystallization, nor vacuum distillation); the cleaning of a definite product--the crystallization from hot water with carbon.

The following are the high discharges which we obtained: stages I-II 93-98 percent, instead of 80-81 percent with Jackson and Manske, stage II-III up to 93 percent, instead of 47-48 percent of the same authors, direct decarboxylizing of decarbonate acid (IV-V) with the escape of 60-70 percent (which could be increased), instead of indirect way through methyl ether of indolyl-oil acid--all these are the distinctive peculiarities of our variation from the methods of Jackson and Manske.

With various modifications of this basic variation we synthesized this spring up to 5 g. of indolyl-oil acid which, after having been handed over to the experimental station TSKEA (Timiriachev Agricultural Academy), proved to be active as a stimulating root forming substance upon grafting of cherries, white cedar (Thuja), potatoes at the concentration from 0.02 up to 0.0025 percent in water solutions.

In order to draw the perspectives which are drawn in case of the accessibility of this substance, let us recall the polyvalent character of the physiological effect of similar substances with the example of heteroauxin. Under certain conditions it causes the acceleration or the retarding of the cell growth longitudinally, under other conditions it stimulates the cell division which leads to a definite morphogenetic effect--root formation, thickening of the stem or of the root; its solutions affect the root growth either retarding or accelerating depending upon concentration, whereby the sensitivity of the root is very great.

Thus, Bidler indicated that by diluting up to 1% in 1 liter, the root growth in water plants is checked (20 percent in comparison with control). Nevertheless, with further diluting we observe growth acceleration: 0.1% in 1 liter accelerate 30 percent (i.e. the dilution of 1 mg. in 10 g. of water).

Geiger-Guber and Burlet indicated that the maximum acceleration of corn root growth occurs under 0.005 γ for 1 liter, i. e. 1 m. for 2000 t. water.

The above ground organs--stems, leaves--are much less responsive to the effect of those substances. In order to stimulate the disturbance in normal morphogenesis of these organs, considerable concentrations are required. Thus, the grafting is achieved with the concentration of 0.005-0.01 percent of heteroauxin.

It is interesting to observe that not only stems, leaf petioles, but even the basic veins of the leaf blades react upon the intensified supply of growing substances (heteroauxin) by the manifestation of the root forming activity. In those domains of these organs, where the concentration of the growing hormone reaches a definite size, there begins an abundant foundation of additional roots, they reach a definite length and under favorable conditions are able to fulfill all functions intrinsic to normal roots.

When heteroauxin is introduced under the bark of a willow or of a poplar, it causes a noticeable division of cambium (Segden).

The academic Kholodnyi (1936) obtained the increase in the growth of vegetative organs and increase in fruit bearing by cultivating oats seeds with heteroauxin (0.01 percent) for twenty-four hours. Timan and Len (1938) observed the same phenomena when carrying out analogous experiments with oats and wheat.

Along and Haundorf (1937) stated the increase of the root mass with radish and sugar beets after hormonizing with heteroauxin.

Stair and Dju-Eai (1938) observed a higher fruit yield after having cultivated tomato seeds with heteroauxin.

Amalong and Haundorf inform about a successful distillation of early lilac by moistening its buds with the solution of heteroauxin for a week.

Thus, in many cases heteroauxin stimulates the development of seeds and of buds which are in a condition of natural rest.

In recent years various explorers in USSR and abroad carried out a great amount of experiments by hormonizing grafts with heteroauxin and with other synthetic compounds. The success of these experiments was of such significance, that at the present time this method begins to penetrate in the horticulture practice.

Among the Soviet explorers we should mention the work of Komissarov (1938) who succeeded in inculcating the grafting of pines and also of N. A. Maximov and Gogolashvili (1937) who obtained good results by cultivating with heteroauxin the graftings of oranges, mandarins and tung trees.

The task of the chemist, as the collaborator in solving this most important theoretical and practical problem, is to make these magic substances accessible to physiological experiment, to experimental and economic application in various domains of plant production. And for this and it is necessary to work out more simple and cheap measures for their synthetic acquisition. Our experimental work is directed towards this aim.

Conclusions

Progress in the field of biochemistry of plants enabled the scientists not only to separate several "growing substances" or phytohormones, but the determination of their chemical qualities placed the question of their synthetic acquisition for utilizing them in plant production.

Among such growing substances of greatest interest are the growing substances which stimulate root formation.

Feofilaktov

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Transl. 213

Among these, of most practical importance are indolyl acidic, naphtha acidic and indolyl-oil acids. Although the latter has not been found in plants, but according to the power of the root forming effect it surpasses many times the natural phytohormone--indolyl acidic acid by affecting plant graftings with the concentration of 0.01-0.03 percent and even 0.001 percent. Two syntheses of indolyl oil acid are known: 1) Jackson and Manske (1930)--composed of cyclohexanon carbon containing acid and aniline; 2) academic S. S. Nametkin with assistants (1941)--obtained it from indolyl and nitrile-chloral oil acid. Both these methods, or due to the complexity and hard accessibility of the initial materials, indicate the fact that indolyl oil acid is not an accessible compound.

As the result of our research, we are able: to simplify considerably the realization of separate stages of the synthesis, based upon the scheme of Jackson and Manske, to increase considerably the solutions according to the stages, and as a whole to use the method of the synthesis of indolyl oil acid from cyclohexanon carbon-containing ether and aniline which are comparatively accessible.

The compound indolyl oil acid which has been obtained by this method, after having been analyzed at experimental stations of "SKEA (Teneriazin Agricultural Academy), indicated conspicuously the expected root forming effect upon plant grafting.

L.A.B.
9-25-51

Dobrotvortseva, A. V.
[(VNIS) (All-Union Institute of Sugar beets - Kiev)]
Pelleting sugar beet seeds with fertilizers. Sakh.
Promysh. 25(2): 39-42. Feb. 1951. 65.8 Sa2

Translated from the Russian by S. N. Monson

The first period in the development of sugar beets (from the appearance of sprouts to the formation of the third pair of leaves) is the most critical. The establishment of conditions contributing to joint, full and healthy sprouts represents therefore one of the major problems for increasing yields of sugar beets and the basic prerequisite for the mechanization of methods for their care.

The principal cause for obtaining thinned sproutings consists, in our opinion, in the common use in industry of the type of sugar beet sliding coulter which does not meet agro-technical requirements. To begin with, it does not meet the chief requirement proposed by Williams concerning the planting of seeds on a firm, settled and moist bed. This type coulter firms the bottom of the trench but its construction is such that the compacted layer of soil introduces the fertilizers into rows and not seeds. Fertilizers are covered with friable, dried soil through side indentations and sugar beet seeds planted on the friable soil. Thus there always is a friable layer, no less than 1.5 cm thick, between seeds and the compact soil layer. The thickness of the former layer may be even larger if the surface layer is dried out. This condition may be eliminated in two ways. First, by constructing a sugar beet coulter of another type to meet agricultural requirements for planting seeds and secondly, by adapting the available coulter for planting sugar beet seeds. This may be done partly if seeds will be planted on the layer of soil firmed by plowing, though this will interfere with fertilization in rows. Planting of seeds together with mineral fertilizers, in prescribed dosages, will lead

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to an increase in the concentration of salines around seeds and may cause depressed plant growth during the initial period of its development. We set ourselves the task to find a better method for improving ^{the} nutrition of sprouting seeds by pelleting them, before planting, with bacterial and organic-mineral fertilizers. Laboratory and field tests were undertaken for this purpose in 1949. Nitrogen, as a bacterial fertilizer; superphosphate (granulated and neutralized) as a mineral fertilizer; peat-phosphorus-potassium fertilizer as an organic-mineral; and humus as an organic fertilizer were used to pellet sugar beet seeds before planting. Nitrogen, of which the reaction is based on the use of the microorganism "azoto-bacter", was taken in the form of peat substance. Humus was taken from a nursery, dried and turned into powder. In obtaining neutralized super-phosphate, wood and hay ashes, and superphosphate ^{these} were turned into dust, strained through a fine sieve, mixed and left to stand for several hours. Ashes amounted to 10 percent of the weight of superphosphates.

Peat-phosphorus-potassium fertilizer of the brand NIUIF contains 50 percent of peat, 20 percent of P_2O_5 , 10 percent of K_2O .

Granulated superphosphate and concentrated peat-phosphorus-potassium fertilizer had a neutral reaction and contained more than one-half of their phosphoric acid in soluble form. Nitrogen and humus were taken in amounts of 20 percent, phosphates--20 percent of P_2O_5 of the weight of seeds, i.e. practically 4-5 times less than the dosage accepted for row fertilization.

The technique of pelleting seeds involved moistening the seeds in water before treatment, and airing them to a point where fertilizers would cling to them without dissolving. Seeds were then gradually and evenly dusted with organic and mineral fertilizers and carefully mixed with a wooden shovel.

Dobrotvortseva

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Transl. 214

Bacteriazation of seeds with nitrogen was performed in a darkened place before treatment with phosphates. The planter was set for planting treated seeds.

On a plot of podzol soil (VHIS) two experiments were made to study results of pelleting seeds before planting, one of which was performed according to superior grade practices, on a well nourished soil (test 1), the other (test 2) on poorly nourished soil. Results are submitted in table 1.

VARIANTS OF TEST	Test 1			Test 2		
	Beet yield (in c/h)	Percent of sugar	Yield of sugar (in c/h)	Beet yield (in c/h)	Percent of sugar	Yield of sugar (in c/h)
Control, seeds moistened in water	271.1	14.5	39.3	143.8	16.07	23.1
Pelleting seeds with nitrogen	303.4	14.2	43.1	154.0	15.73	24.2
Pelleting seeds with nitrogen and peat-phosphate	317.4	14.3	45.4	167.6	15.56	26.1
Pelleting seeds with granulated super-phosphate	277.5	14.0	38.9	146.7	15.53	22.8
Pelleting seeds with nitrogen, & neutralized super- phosphate	282.7	14.2	40.1	162.9	15.33	25.0
Pelleting seeds with peat-phosphorus	298.3	14.2	42.4	-	-	-
Pelleting seeds with humus	-	-	-	151.7	15.71	23.8
20 kg/h P_2O_5 10 15 K_2O in row fertilizing..	-	-	-	152.1	15.67	23.8

In test 1 an additional yield of 27.7 c/h was obtained from pelleting seeds with nitrogen, while pelleting seeds with nitrogen and peat-phosphorus produced an additional yield of 41.7 c/h. Pelleting seeds with peat-phosphorus alone increased the yield by 22.6 c/h. In test 2 the highest increase of 23.8 c/h was also obtained from pelleting seeds with both nitrogen and peat-phos.

By pelleting seeds with nitrogen alone the increase was 10 c/h, while the combined treatment of nitrogen and neutralized superphosphate resulted in 19.1 c/h. Reduced fertilization of the test field reflected upon the absolute yield and the size of additional yields. This may be attributed to the accelerated biological activity of azotobacter on better cultivated soils.

In test 2 attention is drawn to poorer results from row fertilization compared to pelleted seeds before planting without PK. Row fertilization gave only 8.3 c/h. Many researchers repeatedly indicated that "azotobakter" is unable to develop and absorb nitrogen without soluble salts of phosphoric acid. E. V. Dianova and A. A. Voroshilova concluded, for instance, following a study of the cause of absence of azotobakter in cultivated soils, that "azotobakter, when introduced into soil without additions, is unable to survive" and that the introduction of phosphate creates conditions favorable for the development of azotobakter. (Scientific-Agronomic Journal, No. 7-8, 1927). Pelleting seeds with nitrogen and subsequent pelleting with a small dose of phosphate will consequently contribute to the increase in the biological activity of azotobakter. The positive reaction of pelleting seeds before planting with small doses of phosphates together with nitrogen was confirmed in field tests conducted at experimental points: Korovinets, Yaltushkov, Bershadskii, Federovka, Shevchenkovo, Rakitianskii and Znamenskino. (table 2)

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Experimental points:

YALTYSHKOV

BERSHADSK

ERDOVSK

Variants of tests:

Variants of tests; Experimental forms.	Yield of beets of (in c/h)		Yield of (inc/h)	Yield Percent Yield of beets sugar (in c/h)		Yield Percent Yield of Sugar (inc/h)	Yield Percent Yield of beets Sugar (in c/h in o/h)		Yield Percent Yield of Sugar (in c/h in o/h)			
	241	15.9		38.3	329		17.3	26.0		377	17.2	64.6
MPK into rows												
Pelleting seeds with nitrogen & neutralized super-phosphate	48	-01	7.4	27	-03	3.6	12	-01	1.7	1.7	02	00
Pelleting seeds with nitrate & granulated super phosphate	37	01	6.2	18	-01	9.5	-10	001	-2.0	1.3	02	3.3
Pelleting seeds with Granulated super phosphate	32	03	5.9	10	-01	1.4	11	-01	1.5	-	03	0.8

CELLULO

RAHITI 1308

MASTCHIO

AFRAME

NPK into rows		232	18.9	43.8	265	18.3	52.2	162	20.1	32.6	280	18.2	51.0
Pelleting seeds with nitrogen & neutralized super-phosphate		9.0	-0.1	1.5	11	0.9	4.6	23	-0.4	3.8	18	-	3.81
Pelleting seeds with nitrate & granulated super-phosphate		2.1	0.2	4.5	-1.0	0.8	2.0	29	-0.1	5.6	13	15	2.86
Pelleting seeds with granulated super-phosphate		18	-	3.5	7.0	0.3	2.1	23	-0.3	4.0	14.4	008	2.74

At Fedorovka, Shevchenkovo and Zemetchino best results were obtained from phosphorus introduced in the form of granulated superphosphate; at remaining experimental points--from phosphorus introduced in the form of neutralized superphosphate. Additional root yields amounted to 11 to 48 c/h; sugar yields--1.7 to 7.4 c/h. Granulated superphosphate introduced together with seeds increased the yield of sugar beets by 7 -32 c/h and of sugar 1.4 to 5.9 c/h, as compared to the introduction of a considerable amount of P_2O_5 into rows (20-25 kg), even though combined with 8 - 12 kg. of N and K_2O

End of article

L.A.F.

9-25-51

Dobrotvortseva, A. V.
[(VNIS) (All-Union Institute of Sugar beets - Kiev)]
Pelleting sugar beet seeds with fertilizers. Sakh.
Promysh. 25(2): 39-42. Feb. 1951. 65.8 Sa2

SB-14

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Pelleting seeds with nitrogen and pent-phosphate	317.4	14.3	45.4	167.6	15.56	26.1
Pelleting seeds with granulated super-phosphate	277.5	14.0	38.9	146.7	15.53	22.8
Pelleting seeds with nitrogen & neutralized super- phosphate	282.7	14.2	40.1	162.9	15.33	25.0
Pelleting seeds with pent-phosphorus	298.3	14.2	42.4	-	-	-
Pelleting seeds with humus	-	-	-	151.7	15.71	23.8
20 kg/h P_2O_5 10 15 K_2O in row fertilizing..	-	-	-	152.1	15.67	23.8

In test 1 an additional yield of 27.7 c/h was obtained from pelleting seeds with nitrogen, while pelleting seeds with nitrogen and peat-phosphorus produced an additional yield of 41.7 c/h. Pelleting seeds with peat-phosphorus alone increased the yield by 22.6 c/h. In test 2 the highest increase of 23.8 c/h was also obtained from pelleting seeds with both nitrogen and peat-phos.

By pelleting seeds with nitrogen alone the increase was 10 c/h, while the combined treatment of nitrogen and neutralized superphosphate resulted in 19.1 c/h. Reduced fertilization of the test field reflected upon the absolute yield and the size of additional yields. This may be attributed to the accelerated biological activity of azotobacter on better cultivated soils.

In test 2 attention is drawn to poorer results from row fertilization compared to pelleted seeds before planting without PK. Row fertilization gave only 8.3 c/h. Many researchers repeatedly indicated that "azotobakter" is unable to develop and absorb nitrogen without soluble salts of phosphoric acid. P. V. Dianova and A. A. Voroshilova concluded, for instance, following a study of the cause of absence of azotobakter in cultivated soils, that "azotobakter, when introduced into soil without additions, is unable to survive" and that the introduction of phosphate creates conditions favorable for the development of azotobakter. (Scientific-Agronomic Journal, No. 7-8, 1927). Pelleting seeds with nitrogen and subsequent pelleting with a small dose of phosphate will consequently contribute to the increase in the biological activity of azotobakter. The positive reaction of pelleting seeds before planting with small doses of phosphates together with nitrogen was confirmed in field tests conducted at experimental points: Korovinets, Yaltushkov, Bershadskii, Federovka, Shevchenkovo, Rakitianski and Zematchino. (table 2)

Transl. 2M

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Dobrotvortseva

Experimental points:

Variants of tests:	KOROVINEYS			YALTUSHKOV			BERSHADSK			FEDOROVSK		
	Yield of beets (in o/h)	Percent of sugar	Yield of sugar (inc/h)	Yield of beets (in o/h)	Percent of sugar	Yield of sugar (inc/h)	Yield of beets (in o/h)	Percent of sugar	Yield of sugar (inc/h)	Yield of beets (in o/h)	Percent of sugar	Yield of sugar (inc/h)
NPX into rows	241	15.9	38.3	329	17.3	26.9	377	17.2	64.8	330	19.8	66.3
Pelleting seeds with nitrogen & neutralized super-phosphate	48	-01	7.4	27	-03	3.6	12	-01	1.7	127	-02	3.09
Pelleting seeds with nitrate & granulated super phosphate	37	01	6.2	15	-01	9.5	-10	-01	-2.0	1.3	02	3.3
Pelleting seeds with granulated super phosphate	32	03	5.9	10	-01	1.4	11	-01	1.5	-	03	0.8

SHEVCHENKO RAKITIANSK ZEMETCHINO AVERAGE

	232	18.9	43.8	285	18.3	52.2	162	20.1	32.6	280	18.2	51.0
NPK into rows												
Pelleting seeds with nitrogen & neutralized super-phosphate	9.0	-0.1	1.5	11	0.9	4.6	23	-0.4	3.8	18	-	3.81
Pelleting seeds with nitrate & granulated super-phosphate	2.1	9.2	4.5	-1.0	0.8	2.0	29	-01	5.6	13	15	2.86
Pelleting seeds with granulated super-phosphate	18	-	3.5	7.0	0.3	2.1	23	-03	4.0	14.4	006	2.74

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At Fedorovka, Shevchenkovo and Zemetchino best results were obtained from phosphorus introduced in the form of granulated superphosphate; at remaining experimental points--from phosphorus introduced in the form of neutralized superphosphate. Additional root yields amounted to 11 to 48 c/h; sugar yields--1.7 to 7.4 c/h. Granulated superphosphate introduced together with seeds increased the yield of sugar beets by 7 -32 c/h and of sugar 1.4 to 5.9 c/h, as compared to the introduction of a considerable amount of P_2O_5 into rows (20-25 kg), even though combined with 8 - 12 kg. of N and K_2O

End of article

L.A.B.

9-25-51

Misevich, Z. A. and Zakharchenko, A. I.
Downy mildew of sugar beets. Sakh. Promysh.
20(6): 31-34. June 1947. 65.8 3x2

Transl. 215: Sugar Beets
SB-15
Translated by R. Dembo

The authors are scientists at the Verkhniachesk experimental-selection station.

Aiming to increase the yield of one of the most valuable plants of sugar-beet zones- sugar-beet plantings, we must concentrate our attention not only upon the requirements of agrotechnic, the achievement in seed varieties, but upon the quality of the planting material as well.

The improvement of planting material should start with rejecting of mother plants in the field, not so much in regard to the size and form of the tubers, but according to the presence of diseases.

Such vegetative diseases, like downy mildew, rust and mosaic disease of sugar beets, by negatively influencing its development during the first year of life transfer upon the plantings through the mother roots. Downy mildew has an especially destructive influence upon the development of plantings. This disease has been first discovered upon the beets in the middle of XIX century in the countries of Western Europe. At the beginning of the XIX century it became widely spread. Thus, in Saxony in 1894 downy mildew of sugar-beet crops reached 40 percent. In Russia this disease appeared in 1915.

In 1927 downy mildew was discovered at the Verkhniachesk Selection Station of Kiev oblast' where it has appeared yearly. In 1941 this disease has been found on 22 farms.

During the German occupation the development of downy mildew has been especially noticeable. According to the data of 1945, the disease embraced 40 percent of sugar-beet farms: about 20 percent of mother sugar-beet crops and about 25 percent of plantings have been infested. The disease is found most often upon young leaves. The manifestation of this disease is easily

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seen by an unaided eye; it has a film of dark gray color with a violet or yellow shade upon the lower (weaker upon the upper side) side of the leaf, at its base.

At the infested places the young leaves thicken, the edges of the leaves turn down, are friable, their growth stops.

In rainy years the infestation is noticed upon old leaves in the form of yellow spots upon the upper side of the leaf, with a dark gray film of mycelium upon the lower side.

With planting plants, downy mildew infests the leaf rosettes and the sprouts of the early stage.

When the sprouts are infested by downy mildew, separate branches, bracts, tubers are affected in various degrees.

The plants affected by downy mildew obtain the quality of "prodiferatsia" (proliferation) during the first and second year of their life.

According to our observations, in 1945 the disease was disclosed upon roots, especially with some varieties, by changing the root form from cone shape into spindle shape, in conspicuously expressed ribbing and the lengthening of the root top.

Meteorological conditions influence considerably the development of downy mildew: wet weather is conducive to its development and, on the contrary, dry, hot weather hampers the formation of spores and the development of conidia and stops the development of the disease. The large mother sugar-beet could serve as the source for the initiation of the disease.

The roots of the mother sugar-beet which are infested by downy mildew, according to Verkhniacnsk station, yielded 55 up to 90 percent of the plantings with external symptoms of the disease.

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The disease could easily transfer from the infested plantings to the mother sugar-beet, if both plants are closely situated.

In order to eliminate the harmful influence of downy mildew upon plantings, we removed 426 sugar-beet tubers which were infested by downy mildew. The tubers were subdivided into five groups according to the intensity of their disease. (see Table I, page 4)

The diseased tubers, stored with sound control tubers, were stored 170 days. When diseased tubers were taken out from storage rooms in spring, 1945, about 4.2 to 23.9 percent perished. Most of these tubers perished by the decay of the central bud.

All tubers which were planted after spring rejection were under observation. About 11 percent of the roots, at the average along all groups, perished at the very outset of vegetation. A larger percentage of the perished ones has been noticed with plants which were infested later.

Among the plants which formed stems, about 13 percent fruitless bushes "kholostiak" and a number of prematurely dried out bushes were observed.

About 44 percent of tubers diseased in their first year did not indicate any symptoms of disease upon plants.

The manifestation of the disease upon plantings of plants which were infested late in their first year of life has been explained as the later phases of development. These very plants yielded a larger amount of plantings with definite symptoms of the disease which corresponds to the conclusions of Verkhniachesk station in 1939.

The plants with definite symptoms of the disease yielded in the second year considerably less crops than the plants which were planted with diseased

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Table 1

The symptoms of the disease of mother sugar-beets	percentage of tubers which per- ished in storage	percentage of tubers of which per- ished at the begin- ning of vegetating	percentage of fruitless bushes	percentage of tubers which did not yield any crops	percentage of plants with disease manifestation at the root at the generative stage
Leaves without film	4.2	14.6	6.2	20.8	33.3
Leaves with film upon the lower side	9.6	12.8	17.2	30.0	36.3
Individual dying of leaves	11.5	11.5	3.9	15.4	35.3
Complete dying of the central bud	23.9	8.3	21.5	29.8	46.2
New, sound, but deformed leaves grow	4.7	7.3	14.9	23.2	83.4
The average	10.6	10.9	13.7	23.6	46.9
					53.1
					53.8
					64.7
					63.7
					66.7

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tubers, but which externally did not manifest any disease. (See Table 2, page 6)

Comparing the seed crops from diseased mother tubers (from bushes with distinctive symptoms of the disease in plantings, from bushes without distinctive symptoms of the disease) with the crops from sound, control tubers, we may come to the conclusion that downy mildew decreases considerably the seed yield in some cases up to 35-45 percent and even more.

A yield equal or close to control is obtained from those diseased plants which are diseased in the second half of the summer of the first year of life and externally they did not manifest any diseases upon the plantings. This has been confirmed by the data of 1946 as well. This year especially harmful influence upon the plantings of mother tubers resulted which recurred three times.

Our research of 1944 and 1945 over the diseased sugar-beet of the first year of life throws light upon the causes for the decrease of seed yield.

Besides of losses of some parts of the buds, including often the central part, the diseased plants have a low saccharinity and a lower weight of the tuber in comparison with the control sound plants of the same variety. This is seen from table 3 which is composed, based upon the analysis 327 of the raion mother sugar-beet on April 29 and infested by downy mildew 24-26 of May. (See Table 3, page 7.)

As it is seen from the data of table 3, the sugar yield for one plant drops at 30 percent under the influence of early disease of downy mildew. The repetition of the disease reflects upon sugar-beet crops by decreasing the yield some times twice, as it is seen from the data on table 4. (page 7.)

The shortage in crops of sugar and of seeds, due to the infestation of sugar-beets by downy mildew, causes considerable losses to sugar beet farms, especially seed producing ones. (See Table 4, page 7.)

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Table 2

The symptoms of the disease of the mother sugar-beet	The average weight of the seeds from one bush		The average weight of seeds from a bush		Percentage of bushes without symptoms of the disease (in percent)	The average weight of seeds from a bush		in percent- age from control (in g)
	Percentage of bushes with defi- nite sym- ptoms of disease	from bushes with con- spicuous symptoms of the dis- ease (in g)	from bushes with con- spicuous symptoms of the dis- ease (in g)	from bushes with defi- nite symp- toms of the disease (in percent)		from bushes with defi- nite symp- toms of the disease (in percent)		
Leaflets without film	25.0	98.0	138	71.0	50.0	151.0	150	100.3
Leaflets with film upon the lower side	35.5	90.0	166	54.5	33.9	120.0	125	96.0
Individual dying of the leaflets	55.4	105.0	153	68.5	19.3	128.0	134	45.5
Complete dying of the central bud	15.5	88.0	140	62.8	54.7	136.0	151	88.5
New, sound, but deformed leaves are growing	16.7	130.0	148	87.9	61.1	112.0	176	63.5
Average	31.6	102.3	148.8	68.9	43.8	129.4	147.2	88.8

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Table 3

The number of plants	Time of infestation	Average weight of tuber	Amount of sugar in percent	Sugar yield from 1 tuber	Sugar yield (in percent) control
120	June	312	16.69	52.1	73.6
103	July	314	16.43	51.6	73.7
44	August	337	17.06	57.5	81.0
200	Sound tubers	380	18.66	70.9	100.0

Table 4

Seed Variety	Average weight from one tuber		
	diseased by downy mildew		
	sound	once	twice three times
1305 Ivanov Station	321	337	291 120
23 Verkhniachsk Station	320	320	336 292

The history of the development of downy mildew at the Verkhniachesk station indicates the fact that, by applying corresponding measures, it is possible to eliminate this disease or to check its development for a long time.

A considerable development of the disease which occurred in 1937 and in 1938 has been checked in the succeeding years by complete isolation of mother sugar-beets from plantings.

A new outburst of the disease occurred only as a result of planting diseased plants upon selection field during occupation.

The shifting of plantings from the mother sugar-beets at a distance of several kilometers (after the deliberation of Verkhniachesk station from the invaders) caused almost complete recovery of mother sugar-beet crops.

Based upon our research and upon the experiment of Verkhniachesk station we would like to recommend the following measures in controlling downy mildew:

1. The shifting of reproductive sugar-beets from planting plantations at a distance of at least 1.5 km; without changing the existing crop rotations and the distribution of plants, this measure could be realized by means of planting reproductive sugar-beets upon a winter field preceding plantings (method VNIS).
2. All the after mowing waste upon the fields planted by sugar-beets, and especially upon empty fields and near them, should be exterminated.
3. We should observe constantly the planting of sugar-beets, especially of reproductive sugar-beets, for an early removal of the diseased plants of the first nests of infestation. Young plants are most susceptible to the infestation of downy mildew. Before the removal of diseased tubers, it is necessary to spray the entire sugar-beets by one percent Bor-

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deaux mixture (insecticide) with a radius of 10 m. from the diseased tubers.

With a considerable amount of infested plants, before their shifting, it is necessary to spray with Bordeaux mixture the entire field.

Systematic removal of all plants infested by downy mildew, provided there is a small amount of them, could save the entire plantation. The postponing of this operation until the beginning of digging should not be permitted under any circumstances.

The dug-out diseased plants should be placed into pails with the solution of formalin or into double sacks moistened by formalin: diseased plants are dug into the same field at the depth of at least 0.5 m.

4. The leaves of root-bearing plants are silosed at the place of the plantations where there was downy mildew disease.

5. The plowing of the field upon which the infestation of downy mildew has been noticed should be plowed at the depth of at least 33 cm.

ADV-9-25-51

Transl. 216: Plant Protection

Vsesoiuznoe Gosudarstvennoe Ob'edinenie po
 Bor'be s Vreditel'iami i Bolezniami v Sel'skom
 i Lesnom Khoziaistve

Postanovleniia, pravila i instruktsii po karantinu protiv vreditel'ei
 i bolezn'ei sel'skokhoziaistvennykh kul'tur (Resolutions, rules and regulations
 on quarantine in controlling agricultural pests and diseases), 2, 70 p.
 1938. 464.9 V962

Translated in part by R. G. Danbo

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ADV-9-25-51

Egrova, V. I. Utilization of
growth substances in the propagation
of fruit and berry crops. Sad i Ogorod, 1946
(4/5): 71-76. Apr./May 1946. 80 Sal3

Transl. 217: Growth Substances

Translated by R. G. Dembo

Among the agricultural technical measures which accelerate the growth of planting material of fruit-berry crops the application of growth substances is of great significance.

Growth substances—phytohormones, or growth hormones—are present in the plants themselves in small quantities and influence greatly the growth process.

In the Soviet Union, as far as studying the physiology of hormonal phenomena of the vegetative organism is concerned, the academic N. T. Kholodnyi played an important role. In 1931 he discovered the stimulating influence of auxin phytohormone upon the initiation and development of side roots in corn sprouts. This observation has been also proved by foreign explorers. The American scientists Zimmermann and Hitchcock, of Bois-Tompson Institute, proved (1935-1936) that the effect of auxin-water solution upon plant grafting accelerates their root formation.

Further they succeeded in separating from some mold-fungi a substance which is similar to auxin and which is called heteroauxin. Hetero-auxin is similar to beta-indolyl-acidic acid. Three growth substances have been discovered: auxin A, auxin B and heteroauxin. In order to obtain auxin (A and B) the urine of animals and man has been used, as initial material, but it is difficult to separate the hormone from urine. Heteroauxin (beta-indolyl-acidic acid) could be prepared by synthetic means.

The following substances proved to be physiologically active: beta-indolyl-propionic, beta-indolyl-oil, alfa-naphtyl-acidic acids. These substances, not being phytohormones, since they are not found in plants, in

many cases surpass natural hormones (heteroauxin).

Figure 1. Currant grafts, Versailles white, a month after planting in the nursery. From left to right: two grafts covered with indolyl-acid during six hours; 2 grafts cultivated during 12 hours; 2 control.

The indicated growth substances are a powerful measure in directing plant growth. They acquired wide application in working out measures for the acceleration of fruit-berries grafts and of other agricultural plants.

The basic work in applying growth substances in the Soviet Union are carried out by the Institute of Physiology of the Academy of Sciences of USSR under the supervision of prof. N. A. Maksimov. The institute worked out methods in applying growth substances.¹

¹ N.KH. Chailakhian and R. KH. Turetskaia, "Short methodical indications on the application of synthetic growing substances for the rooting of grafts". Moscow, Publications of the Academy of Sciences of USSR, 1942.

In these instruction is given the description of the technic of applying growth substances and a table is given of the results of their application during grafting of individual plants.

Valuable results in grafting forest and fruit crops were obtained by Komissarov (1936) at the Leningrad Forest-Technical Academy, Gogoloshvili (1937-1938) at Batum Botanical Garden, Kochershenko (1939) at the Sukhumi Central Selection Station of Subtropical Plants, Tarasenko at Timiriasev Moscow Agricultural Academy and others.

At the Moscow Experimental Selection Station of Main Conserv of the Ministerium of Food Industry of USSR, in working out measures for the acceleration of propagation of fruit-berries crops, the growth substances were tested in 1944-1945. In 1944 heteroauxin was tested in relation to the

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acceleration of grafts of various varieties of black, red and white currant. Heteroauxin was taken at the concentration of 0.01 percent (100 mg for one liter of water). In connection with the degree of graft lignification, a varied exposition was accepted (the time length of the effect of the solution of the growth substance):

- for the lignified grafts of black currant-24 hours;
- for lignified grafts of red and white currant-48 hours;
- for green grafts of black currant-4 hours;
- for green grafts of red and white currant-8 hours.

The lignified grafts were taken at the length of 18 cm, the green grafts were taken at the length of two internodes. The grafts were bound into bundles of 30-50 pieces and placed in the heteroauxin solution of 2-3 cm depth. About ten thousand of lignified currant grafts were treated by heteroauxin. The experiment has been carried out under industrial conditions. The positive effect of heteroauxin upon the lignified grafts planted into the ground in spring has been determined. The treated grafts, depending upon the variety, formed roots 7-12 days earlier than the control ones. During the unfavorable spring of 1944 which was famous by a drought, the grafts which were treated by heteroauxin formed roots sooner than the control ones and produced the sprouting of two year sprouts with all currant varieties. The sprouting of two year currant increased along many varieties of treating the grafts with heteroauxin at 13-50 percent. The general condition of plants treated with heteroauxin, was different from the control ones during the first year of their life. The treated grafts grew faster and yielded big bushes.

In 1945 we extended our experiment and besides of heteroauxin we tested the effect of indolyl-oil acid. Growth substances were tested upon green

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grafts of currant, gooseberry and cherries. The treating of currant and gooseberry grafts with growth substances was carried out in three terms: June 25, July 15, and August 1; on cherries once—July 3..

In the experiment with currant the following varieties were taken: the black currant—"Liia plodorodnaia", "Koronatsia"; red currant—"Varshevich", Holland; white currant-Versaille, English. Three varieties of gooseberry were taken: "Khanton", green "Finik" and English yellow. Nine varieties of cherries were taken, including the old Russian varieties-Vladimirskia, Liubskia, Kentaskia, of the Michurin varieties-Plodorodnaia Michurina, Kraska Severa, Shiroptreb chernaia, Iubileinaia, Monomakh and Zhakharovskia.

For currant and gooseberry-the growth substances were applied at the concentration of 0.005 percent (50 mg for one liter water). The exposure for currant was accepted 6, 12 and 24 hours, and for gooseberry-12 and 24 hours.

The green grafts were cut in two internodes; in order to decrease the water evaporation through the leaves, the leaf surface was decreased in a half.

The green grafts were taken from the currant bushes six years old, the grafts of gooseberry-four years old. The cherry grafts were cut in the middle of the crown of trees six years old. Altogether 10 thousand green grafts were cut and treated with growth substances. The planting of graftings was carried out in nurseries where tomatoes previously grew. For the rooting of green graftings we may utilize nurseries previously used for cabbage.

The graftings of currant and of gooseberry affected by the growth substances form roots much faster than the control graftings. During this treatment the growth of roots accelerates and their power increases.

Figure 2. Currant graftings of Holland red, one month after planting in nursery: from right to left: 3 graftings treated by indolyl-oil acid; 3 control.

As a result of an intensified development of the root system the growth of the over ground parts accelerates. The plants obtained from graftings which were treated with growth substances grow faster and develop a more powerful leaf surface, as, for instance, with the acceleration of graftings of Versailles white currant. As it is indicated upon the drawing 1, the most effective was the 12 hour exposure; the roots were more powerful. The control graftings did not form any roots at that time.

Indolyl-oil acid was physiologically more active than heteroauxin. We must mention that heteroauxin, besides of being less active, disintegrates easily and loses its characteristics quickly. Therefore, before using heteroauxin, its physiological effect upon the plant should be tested.

The following results were obtained on June 25 during the treatment of graftings of currant, English white variety, with indolyl-oil acid (0.005 percent): with the exposure of 6 hours 41.0 percent gave roots, with the exposure of 12 hours-73.7 percent. The control graftings gave roots 38.5 percent.

The variety English white, when treated with indolyl-oil acid, with the exposure of 6 hours, gave the best results. The amount of the root producing plants increases almost twice in comparison with the non-treated plants.

The currant variety Holland red which produces roots with difficulty formed roots after its graftings were treated with indolyl-oil acid (0.005 percent): with the exposure of 6 hours-26.6 percent; with exposure of 12 hours-73.3 percent.

The control graftings accelerated 17 percent.

The best result was obtained by treating the graftings of Holland red with indolyl oil acid for 12 hours; the amount of plants which formed roots increases more than four times in comparison with

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the non-treated (figure 3).

The graftings of black currant form of the same amount roots whether they were treated with a growth substance or not. But those which were treated, form roots faster and develop better during the first growth period. (figure 3).

Under the influence of indolyl-oil acid and of heterosauxin, the green graftings of gooseberry form a root system 7-10 days sooner and more powerful than the control ones. As a result of an accelerated root growth, sprouts are formed. Due to the fact that the roots with the green currant graftings usually are formed with difficulty, the application of growth substances is important.

The indolyl-oil acid at the concentration of 0.005 percent at the exposure of 24 hours had a good effect upon the root formation of gooseberry graftings. (Figure 4):

Gooseberry graftings Finik green 50 days after the planting into the nursery. From left to right: 2 graftings treated by indolyl-oil acid for 24 hours; 2 control graftings.

The graftings of Khauton variety treated with indolyl-oil acid, formed roots 77.4 percent and the control ones 59.5 percent; the treated graftings of green "Finik" formed roots 66.7 percent, the control-37.8 percent, treated yellow English-44.2 percent, control-27.0 percent.

Best results in root formation were obtained from early graftings-June 25. The worst results were obtained with the graftings on July 15 and August 1.

By observing the nature of root formation with the cherries, under the influence of indolyl-oil acid it has been stated that all cherry varieties in propagating by means of green graftings are able to form roots. The percentage of root forming plants fluctuate with each variety. Zakharovskaja,

Vladimirskaia, Shirpotreb black and Monomakh form roots easily. Kentakaia and Liubekaia form roots with difficulty. With the concentration of indolyl-oil acid at 0.005 percent, best exposure for the majority of varieties was 12 hours.

Under this exposure the green graftings of cherries accelerate their root formation and root growth in the length. (Figure 5).

Figure 5. Cherry graftings variety Liubekaia 15 days after planting in the nursery. From left to right: 2 graftings treated by indolyl-oil acid for 12 hours; 2-control.

When green graftings of cherries were exposed for 24 hours in a solution of indolyl-oil acid (0.005 percent) this was destructive for "Shirpotreb", "Iubileinaia", "Plodorod Michurin" whose leaves became soon yellow and fell off, and instead of roots a callus was formed which required a great expenditure of the nourishing substances of the grafting due to which it weakens, roots are not formed, the bud does not open and the graft perishes.

The experiments which were carried out at the Moscow experimental-selection station enable us to arrive at the following conclusions:

1. The application of heteroauxin upon lignified graftings of various varieties of currant caused the acceleration of root formation in 7-12 days. The graftings which were treated with heteroauxin accelerated the sprouting of two year plants 13-50 percent (depending upon the variety).
2. Indolyl-oil acid has a physiologically active effect upon the root formation of currant graftings. Under the influence of this acid the root formation accelerates and the strength of the root system increases as a whole.
3. The basic and determined moment in applying growth substances is the best concentration and the duration of the grafting exposure in the solution.

Egorova, V. I.

Transl. 217: Growth Substances

The application of indolyl-oil acid in the concentration of 0.005 percent (50 mg for a liter of water) increased the percentage of the root formation of the green currant graftings. Thus, for instance, with variety English white when treated with indolyl-oil acid (July 25), for 6 hours the number of root forming plants increased twice in comparison with control plants.

With graftings of Holland red (hard root forming) the number of root forming plants, in comparison with control, increased 4 times under the effect of indolyl-oil acid during 12 hours.

4. Green graftings of gooseberry are greatly affected by indolyl-oil acid. Indolyl-oil acid in the concentration of 0.005 percent with the exposure of graftings in its solution for 24 hours give good results. The root formation increases 17-30 percent (depending upon the variety) in comparison with the control ones.

5. Under the influence of indolyl-oil acid upon the green cherry graftings, the root formation is accelerated. The green graftings of the majority of cherry varieties reacted well to indolyl-oil acid with a concentration of 0.005 percent (50 mg for one liter of water) for 12 hours. When the exposure in the indolyl-oil acid solution lasted 24 hours, the reaction of the varieties: black Shiroptreb, Iubileinaiia, Plodorodnaia Michurina and Kentakaia, was negative.

Geller, I. A. and Khariton, E. G.
The utilization of nitrogen bacteria and
other microorganisms for increasing the
yield and sugar content of sugar beet.
Sovet. Agron. 9(3):65-68. Mar. 1951 20 So84

Transl. 218: Sugar Beets

Translated by R. G. Dembo

(The authors are connected with the All-Union Scientific-Research Institute
of Sugar-Beets)

Root secretions and dying parts of the root system are the source for
carbon and mineral ash nourishment of many organisms which inhabit the root
zone.

According to the calculation of Krasil'nikov, the weight of micro-
organisms of the plant root zone (rhizo-sphere) reaches 60 c/ha, while
in the rest of the soil mass their weight reaches about 20 c/ha. The amount
and the content of the microorganisms in the rhizo-sphere are fluctuating
during vegetation reaching greatest density during the initial growth phases
and during blooming.

The high density of the micro-organisms in rhizosphere indicates that
these very organisms influence in a considerable degree the activity of the
higher plant, neutralizing the products of root secretions and plants and
taking direct part in providing the plants with the elements of ash and
nitrogen nourishment.

As a whole, the life activity of the microorganisms of the rhizo-
sphere is a favorable factor for the growth and the development of plants.
But, there is no reason to believe that all microorganisms which are found
in rhizosphere affect the plant equally favorable, since the products of
substance exchange of various organisms are of different kind, thereby
affecting the plant in a different manner.

This results into a practical problem: to fill the rhizo-sphere with
microorganisms which are useful for the given plant. Of the rhizosphere

microorganisms, according to numerous experiments, nitrogen fixing bacteria (in particular, Azot^obacter) improve the conditions of the plant's life activity and by this the introduction of Azotbacter with seeds directly into the soil is of great agricultural importance for the increase of yield and the improvement of the quality of the production of agricultural crops.

In respect to sugar-beets, our research indicated that the saturation of sugar-beet tubers with Azotbacter increases both the yield and the saccharinity of the sugar-beets. The data of 1949 concerning the yield and the saccharinity of subar beets after the experiment with azotbacterin are given in the table 1.

It is most important that with the increase of soil fertility the effect of azotbacterin increases.

Thus, for instance, at Zemetchinsk variety field without fertilizers we acquired the increase of yield of sugar-beets from azotbacterin-13 c/ha, and by applying mineral fertilizers the increase due to azotbacterin was 46 c/ha of sugar-beets. (See Table 1, page 3)

Analogous results were obtained by A. V. Dobrotvortseva at the experimental field of the All-Union Scientific-Research Institute of Sugar Beets in the experiments with azotbacterin. Upon a soil which has been treated with sulphur and some ashes she obtained a sugar-beet yield of 144 c/ha and an increase from azotbacterin-10.2 c/ha; upon a field with a higher level of fertility she obtained the same year a higher yield-27.1 c/ha and the increase due to azotbacterin was 32.3 c/ha.

During the experiments upon black soil, by adding mineral ashes, at the Umansk Selection Station of the All-Union Scientific-Research Institute of Sugar-Beets, in producing sugar-beets upon the nourishing field of 45 X 40 cm,

Geller, I. A. and Khariton, E. G.

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Table 1

The place of the experiment	Yield of tubers in c/ha		Saccharinity	
	CONTROL	AZOTOBACTER	CONTROL	AZOTOBACTER
The Verkhniachesk experimental Selection Station of the Order of Labor of Red Banner.....	349.0	371.5 ✓	17.7	17.8
Ivanovsk Experimental Selection Station.....	383.0	387.5 ?	18.1	19.1 ✓
Korovinetsk Variety Field...	204.0	239.0 ✓	15.4	15.8
Shevchenkovskii Variety Field.....	228.0	255.5 ✓	18.3	18.5
Parafievskii Variety Field.	285.1	306.8 ✓	17.5	17.5
Kozhanskii Variety Field...	336.0	385.8 ✓	16.7	16.9
Dolinskii Variety Field....	159.5	173.6 ?	18.0	18.2
Batyeva Mountain (Experimental Field VNIS).....	215.0	236.0 ✓	14.5	15.6

we acquired an increase in yield from azotbacterin-56.5 for each tuber, and while producing sugar-beets upon a field of 45 x 20 cm the increase in weight of one tuber was at the average 3.3 g., i.e. the effect of azotbacterin increased considerably under the best conditions for sugar-beets.

Thus, with the increase of the soil fertility, the effect of the measures of applying bacterial fertilizers will increase.

Along with the increase of the yield it has been determined that sugar-beet seed bacterization with azotobacterin increases the saccharinity of sugar beet as well. The data given in table 1 indicate that in the experiments of 1949 the increase of sugar percentage in sugar-beet tubers by applying azotobacterin was 0.3-0.5 percent, and in individual cases reached 1 percent.

Due to the importance of the problem of the increase of sugar-beet saccharinity, the research in this direction has been extended. The influence of Azotbacter upon sugar-beet varieties-its yield and saccharinity has been experimented upon various nourishing fields.

It became evident that the influence of Azotbacter upon sugar-beet quality depends upon variety peculiarities and upon the conditions of variety production. The data of 26 experiments with black soil, which has been treated with mineral ashes, at the Umansk Selection Station (the experiments were carried out by A. F. Nikolaeva) indicated that the sugar-beet varieties of high saccharinity react positively to Azotbacter during vegetation, but at the end of vegetation this effect becomes hardly noticeable or even negative. For sugar-beet varieties a drastic increase in saccharinity has been noticed at the end of vegetation.

In table 2 is indicated the increase of the percentage of sugar from azotobacterin. (Table 2, page 5)

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Table 2

Number of Varieties	the nour- ishing field in cm	Sugar percent- age	Increase of sugar from Azotbacterin in percentage		
			5/VII	5/VIII	5/IX
5	45X20	18.3-19.1	-0.1	+0.6	+1.6
4	45X40	18.7-18.9	-0.4	+1.1	+1.2
8	45X20	19.9-21.2	+0.7	+0.1	-0.3
9	45X40	19.8-21.0	+1.05	+0.9	-0.15

It is advisable to apply azotbacterin first of all for varieties, as for yield, under practical conditions of collective farms and state farms; and the problem of applying azotbacterin for the varieties, as to saccharinity, is necessary to work out by the experimental method.

The experiments indicate also that it is possible to increase sugar-beet yield as well as saccharinity by means of other bio-compounds. In our research we tested the effect of mold fungi Trichoderma lignorum and Pennicillium chrysogenum. The data of three year experiment indicated that the saturation of sugar-beet seeds with the spores of Trichoderma lignorum causes the increase of sugar-beet yield and saccharinity. In our experiments we compared the effect of Trichoderm and of Azotbacterin. The results of the experiment are given in table 3. (Table 3, page 6)

At the average, the increase of sugar-beet tuber yield from azotbacterin during three years of these experiments is 17.3 c/ha, and from Trichoderma- 18.5 c/ha. The increase of the percentage in sugar content is at the average 0.3-0.4 percent.

Table 3

The place of the experiment	Year of experiment	Control		Trichoderma		Azotbacter	
		root yield in c/ha	sugar in percent	yield in c/ha	sugar in percent	yield in c/ha	sugar in percent
Zgurovsk variety field	1946	141.1	16.0	161.2	16.3	159	16.0
Zametchinsk variety field	1947	200	17.7	233	18.6	213	18.4
Deriuginsk variety field	1947	190.6	19.5	191.8	19.9	193.3	19.9
Zametchinsk variety field	1948	148	18.2	171	18.4	179	18.4
Deriuginsk variety field	1948	212	17.9	217	18.1	219	18.0
Bershadsk variety field	1948	303	17.3	323	17.4	325	17.3
Dolinsk variety field	1948	179	16.0	187	15.9	187	16.0

Table 4

Fertilization	Control		Trichoderma		Penicillium	
	yield in percent	sugar in percent	yield in percent	sugar in percent	yield in percent	sugar in percent
Without fertilization	100	16.9	103.0	17.3	106.0	14.4
NPK.....	100	17.4	110.1	17.7	106.1	17.4

Practically the same results were obtained in our experiment upon gray soil of Batgory (experimental field VNIS) which has been partly treated with mineral ashes, in comparison with the effect of *Trichoderma lignorum* and *Penicillium chrysogenum*.

In table 4 is indicated the influence of *Trichoderma* and *Penicillium* upon the sugar-beet yield and saccharinity. (See Table 4, page 6)

In the experiments of I.A. P. Podtykan who examined the effect of all bio-compounds indicated above upon the soil of Batgory which has been treated with phosphor-medium mineral ashes, with the yield of control field 422 c/ha, the increase of crops from azotbacterin was 23 c/ha, from *Trichoderma*-24 c/ha, and from *Penicillium*-28 c/ha, and the sugar content from azobacterin increased at 0.7 percent, from *trichoderma*-0.2 percent, and from *penicillium*-1.2 percent.

Thus, the saturation of sugar-beet seeds with useful micro-organisms causes yield increase and improvement of tuber quality.

The basic problem then is to introduce widely these measures into collective and state farm production and to work out means for further increase of the effect of bacterial and fungi compounds.

The possibilities in this direction are tremendous, applying, for instance, the complexes of useful microorganisms. Taking into consideration that the mold fungi *Trichoderma* and *Penicillium* improve the life activity conditions of the sugar-beet not at the expense of soil wealth connected with nitrogen, since they do not fix nitrogen in noticeable quantities, we may expect that by applying them with Azotbacter the effect of such a complex should increase considerably.

Without making any decisions a-priori, we should take notice of the fact that the problem of regulating the life activity of soil micro-flora,

Geller, I. A. and Khariton, E. G. Transl. 218: ~~Sugar~~ Beets

according to Williams' theory, is of great practical significance. The further development and application of Williams' theory should be extended by an active interference into the biological life of the soil, and, particularly, by wide application of a series of biological compounds which are used under specific soil-climatic conditions, with the consideration of the biological peculiarities of various varieties of agricultural crops.

ADV-9-26-51

Geller, I. A. and Khariton, E. G.

Transl. 218: Sugar Beets

The utilization of nitrogen bacteria and other microorganisms for increasing the yield and sugar content of sugar beet.
Sovet. Agron. 9(3):65-68. Mar. 1951 20 So84

SB-16

Translated by R. G. Dembo

(The authors are connected with the All-Union Scientific-Research Institute of Sugar-Beets)

Root secretions and dying parts of the root system are the source for carbon and mineral ash nourishment of many organisms which inhabit the root zone.

According to the calculation of Kraail'nikov, the weight of microorganisms of the plant root zone (rhizo-sphere) reaches 60 c/ha, while in the rest of the soil mass their weight reaches about 20 c/ha. The amount and the content of the microorganisms in the rhizo-sphere are fluctuating during vegetation reaching greatest density during the initial growth phases and during blooming.

The high density of the micro-organisms in rhizosphere indicates that these very organisms influence in a considerable degree the activity of the higher plant, neutralizing the products of root secretions and plants and taking direct part in providing the plants with the elements of ash and nitrogen nourishment.

As a whole, the life activity of the microorganisms of the rhizo-sphere is a favorable factor for the growth and the development of plants. But, there is no reason to believe that all microorganisms which are found in rhizosphere affect the plant equally favorable, since the products of substance exchange of various organisms are of different kind, thereby affecting the plant in a different manner.

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Thus, for instance, at Zemetchinsk variety field without fertilizers we acquired the increase of yield of sugar-beets from azotbacterin-13 c/ha, and by applying mineral fertilizers the increase due to azotbacterin was 46 c/ha of sugar-beets. (See Table 1, page 3)

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Galler, I. A. and Khariton, E. G. Transl. 218: Sugar Beets

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Galler, I. A. and Khariton, E. G. Transl. 218: Sugar Beets

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ADV-9-26-51

219

Edel'shtein, M. M. External
preharvest feeding of sugar beets.
Sakh. Promysh. 24(5):39-41. May 1950
65.8 Sa2

Transl. 219: Sugar Beets

SB-17

Translation by R. G. Dembo

During recent years, in the field of plant feeding, the principle formulated by the academic Williams, that the plant itself should be fed and not the soil, acquired more importance.

In the system which has been worked out we may consider the external feeding as quite effective. By means of this measure we free ourselves from the temporary correlation between fertilizer and soil and we obtain a stronger effect upon the substance exchange in plants.

T. D. Lysenko says that the "cause for the change of the nature of a living organism is the change of the type of assimilation, the change of metabolism."

By actively interfering into metabolism we are able to change their nature.

A leaf is the organ where the initiating formation of an organic substance occurs, where the peculiarities of metabolism are most conspicuous, as well as the connection of individual metabolisms which determine the processes of synthesis and the disintegration of the organic substance. Therefore, the external feeding, i.e. the introduction of nourishing elements into the plant through the leaves is of great interest.

Experiments with external feeding were carried out in the Soviet Union by P. Zheleznov, K. Domantovich, F. Matsnov and L. Forfel'. In their experiments the yield of sugar-beets increased by 65 percent. According to the data of the Institute of Sugar-Beet Production, the root feedings increased the sugar-beet yield by 26-40 c/ha, which forms an increase of 16 percent.

Edel'shtein, M.M.

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The sugar-beet leaf blades contain 4-5 percent sugar at the time of harvest which constitute between 10 to 15 percent of its general availability of the entire plant (leaves plus root). Thus, within the leaves a considerable part of sugar produced by the plant remains unutilized in sugar production.

It has been determined that the sugar which exists in sugar-beet leaf blade in the form of saccharose runs into the root as simple sugar-monomer.

For a long time the separation of saccharose into monosugar has been possible by means of hydrolysis which occurs, due to the effect of the fermentation of saccharose of invertase.

According to contemporary conceptions, phosphoric acid plays a decisive role in carbohydrate metabolism of plants. Along with the processes of hydrolysis, there occurs in the plants a process so called, phosphorolysis, i.e. the joining of carbohydrates of phosphoric acid to the molecule, as a result of which phosphoric ethers are formed. These compounds (glucosophosphates) have a considerably higher potential. The synthesis of complicated carbohydrates-starch, saccharose, could go, seemingly, only by means of preliminary phosphorelizing of sugars. On the other hand, with the interior cell decomposition of complicated carbohydrates into monosugar, phosphoric acid has to be added. Thus, both the synthesis, and the decomposition of complicated carbohydrates could occur only with the presence of phosphoric acid and is catalized by a specific fermentation-phosphorylosis.

It is well known, that phosphates and potassium, when introduced into the soil, assist in the accumulation of sugar in the roots. Thus, according to the data given by academic I. V. Yakushin in his text-book "Plant Production", phosphates introduced under sugar-beets (basic fertiliza-

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Transl. 219: Sugar Beets

tion plus planting in rows and feeding) increase the saccharinity of roots from 0.35 up to 0.7 percent, and potassium, from 0.4 to 0.9 percent, depending upon the type of the soil.

Taking into consideration the role of phosphorus and potassium, we carried out experiments of external feeding of sugar-beets with the solution of phosphoric acid and potassium during preharvest period at the Timiriazev Agricultural Academy under the direction of the academic I. V. Iakushin. Our basic problem was the increase of saccharinity of the sugar-beet tubers.

As sources for phosphoric acid and potassium were applied superphosphate and potassium chloride which are widely used on farms.

For the solution were taken ten parts of water for one weight part of superphosphate which contained 17 percent of P_2O_5 . With such correlation we obtained an extract which contained P_2O_5 around 1.7 percent. The solution concentration of potassium chloride was 0.6 percent. For spraying we used the kit sprayer "Avtomak".

The external feeding was carried out during non-rainy days, because a rain which would come after spraying would wash down the solution which was placed upon the leaves. The best hours for spraying are from nine in the morning and from four in the afternoon until seven in the evening. Since the leaf must preserve the solution drops at least for half an hour, it would be meaningless to carry out a feeding during hot hours of the day.

The escape of the solutions for 1 m² - was 0.3 liter.

In 1947 we carried out an investigating experiment. The sugar-beet spraying was carried out in two terms: upon one field on September 19, and upon another field-September 28.

The percentage of sugar in sugar-beet tubers (saccharimeter) yielded results which are given in table 1. (Page 4)

Table 1

Time of Spraying	Time of Analysis	Percentage of sugar after feeding		
		Control (water)	Extract superphos- phate	Solution KCl
September 19	September 23	12.5	13.90	---
September 28	October 5	13.02	14.92	14.22

From the data of table 1 we see that the preharvest external feeding of sugar-beets with the solution of phosphoric acid and with the solution of potassium chloride yielded a considerable increase in sugar percentage in the tubers (about 2 percent) in comparison with control tubers.

In 1948 this experiment has been carried out three times upon a field of 600 m².

The experiment scheme: 1-control, 2-superphosphate mixer, 3-potassium chloride. The spraying of sugar-beet leaves has been carried out on September 15, the sugar percentage in the sugar-beet tubers was determined on the fifth day after spraying (sugarmeter).

Table 2

Experiment Variations	Percentage of sugar in the tubers			
	I	II	III	Average
1. Control	15.45	15.30	16.05	15.67
2. Superphosphate	16.15	16.35	16.60	16.37
3. Potassium chloride	18.10	16.80	16.20	17.00

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The data of table two indicate that 1) the amount of sugar in the roots sprayed by superphosphate solution is 0.7 percent higher than in the roots of control plants; 2) in plant roots which received a feeding with the solution of potassium chloride there is 1.33 percent more sugar than in the tubers of control plants. The conspicuous difference in the effect of external feeding, according to the years (1947-1948), could be explained by the difference of temperature conditions during feeding. In 1948 the end of the summer and the fall was cool which encumbered the penetration of the solution into the leaves which negatively influenced the fermenting processes which occurred in the leaf.

In 1949 the experiment was repeated three times upon a field of 600 m². The subdivided fields were 30 m²; the field was divided into two parts; the spraying was carried out in two terms (the first field on August 29). Four days after spraying there was in the sugar-beet tubers the following amount of sugar: (see table 3)

Table 3

Experiment Variations	Percentage of sugar in the tubers			
	I	II	III	Average
1. Control	11.13	10.85	12.18	11.39
2. Superphosphate	12.92	12.33	12.80	12.69
3. Potassium chloride	12.34	12.54	13.06	12.65

As we see from the data of table 3, after spraying, the leaves with the solution of P₂O₅ contained 1.3 percent more sugar than in control tubers, and 1.26 percent more than in the leaves which were sprayed by potassium chloride.

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The feeding upon the second field was carried out later-on September 15. Sugar percentage in the tubers was determined six days after the feeding. In this case the sugar percentage in the roots increased in comparison with the tubers of control plants: by 0.56 percent from the feeding with solution P_2O_5 , and by 0.89 percent from the feeding with the solution of potassium chloride. Thus we may say that a later spraying (later than the second half of August) yields an inferior effect.

The sugar-beet crops were harvested on October 3. In comparison with control plants, the sugar percentage in sugar-beet tubers which were sprayed on August 29 with the solution P_2O_5 increased by 1.85, and in tubers sprayed with the solution of potassium chloride by 2.289.

The tuber yield has increase (in comparison with control plants) by 9.1 percent due to superphosphate feeding, and by 10.9 percent due to potassium chloride feeding. Sugar yield from the field which was sprayed with the extract of superphosphate surpassed the control field by 22.5 percent, and from the field sprayed by potassium chloride by 26 percent.

In 1949, we carried out at the Ramon Selection Station an experiment, in collaboration with the workers of Agricultural Division of Civilian Aviation, with external preharvest feeding by spraying sugar-beets from an airplane (1 ha). The feeding was carried out on September 10, and the sugar percentage was determined six days after spraying. The superphosphate feeding of sugar-beets from an airplane increased the sugar content in the roots by 1 percent, the yield was 427 c/ha while the yield from control field was 392 c/ha.

In order to decrease the consumption of the sprayed solution, the concentration P_2O_5 of the extract was increased up to 5 percent, and its

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consumption decreased by 800 litres per hectare. It is necessary to notice that, by spraying from an airplane, a thin and equal spraying of the solutions is achieved.

The indicated results from airplane feeding of sugar-beets confirm the data obtained upon the Field Experimental Station of the Timiriazev Agricultural Academy.

It is necessary to indicate that the Department of Plant Production of Timiriazev Agricultural Academy carried out in 1949 an external feeding of sugar-beet seeds which also caused an increase in seed yield.

For two years (1948- and 1949) we carried out experiments with external feeding of wheat with phosphoric acid at the moment when the grain started to fill. As a result, we noticed an increase of yield by the increase of the absolute weight of the grain and the decrease of the amount of undeveloped ears in the lower part of the wheat ear. This confirms the positive role of phosphorus in the movements of carbohydrates within the plant.

Conclusions

The external preharvest feeding of sugar-beets with the solutions of phosphoric acid and of potassium chloride increases considerably sugar percentage in the tubers and the yield by up to 10 percent.

The preharvest external feeding of sugar-beets should be carried out in the second decade of August and not later than ten days before the harvest.

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News in science concerning a biological species.

Akad. Nauk SSSR. Vestn. 21(3): 66-75.

March 1951. 511 Ak14V

Translated by S. N. Muneon

(Report presented at the annual meeting of the Academy of Science of USSR on Feb. 2, 1951).

Up to the present time biological science has no clear understanding of the term "species". This despite the fact that every biologist who observes living nature, and especially practical agricultural workers dealing in plants, animals and microorganisms, are first confronted with the circumstance that all interrelated organic nature consists of separate forms distinct in quality.

It is recognizable in agricultural practice that among animals, the horse, cow, goat, sheep and others represent individual forms of animals, distinct in quality; while among plants, i.e. wheat, rye, oats, barley, carrots, etc., the same applies to them. This is equally true in uncultivated, wild nature that surrounds us. Everyone is able to distinguish between an oak, a birch and a pine tree, all representing separate characteristic forms.

Interrelated living nature consists, as stated above, of individual forms of plants, animals and microorganisms. These forms of organisms which under normal conditions do not cross or do not produce normal and fertile progeny if crossed, i.e. are physiologically incompatible, are called species. In agricultural practice and especially in natural science special forms that do not commonly cross and are distinctly different, though close, are frequently referred to by the same name, i.e. plant and animal species.

Thus the designation wheat is applied to common soft wheat, hard wheat,

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one-grain, two-grain, etc. wheat. The name dandelion is usually also applied to some non-crossing separate forms distinct from each other, i.e. species. To fix the concept of these forms, (i.e. species) botanical and zoological science has long ago systematized (Linnaeus, 1707-1778) dual designations for species in the Latin language. Hence, Triticum vulgare - common, soft wheat; Triticum durum - hard wheat; Triticum monoccoccum - one-grained wheat, etc. The first part of the name is the noun indicating the genus common to all related species united in practice and science (systematics) into one genus. The second part of the name is the adjective, such as common "vulgare" or hard, "durum", indicating the concrete form of a species of plant or animals.

When dealing in practice with one species of a plant or animal, species are designated only by the genus name such as, for instance, wheat, pine, or horse, sheep, goat. In dealing, however, with several related species a dual designation is used, such as common wheat, Triticum vulgare, etc., or one of the species is named by the genus (common, soft wheat is usually referred to as wheat only) and the other species, i.e. Triticum dicoccum, given another designation, name - Triticum spelta. The very structure of living nature consisting of groups of species, resembling each other but nevertheless separate, distinct, non-crossing under ordinary living conditions, served as an indication to naturalists that species originate from each other, that related species have much in common and that this similarity reflecting upon the unity (tie) in their origin, points to a common genus. Nature itself forced dual designations for species upon science.

Pre-Darwin biology maintained a metaphysical, anti-scientific view

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upon a species. The belief prevails that forms of species are unalterable and not connected with each other in any way in their respective origins and developments. It was asserted that species cannot originate from each other, that they supposedly are created separately and are independent of each other.

Lamarck and particularly Darwin rejected the erroneous claim of metaphysical biology with regard to the perpetuation and invariability of forms of species and their independent origin by establishing their theory of evolution.

Darwin proved in his evolutionary theory that all vegetative and animal species originate from each other. He thereby established that living nature has its history, its past, its present and its future. Therein lies one of the immortal services rendered by Darwin. Basic darwinism, however, is only one-sided, flat evolutionism. Darwin's theory of evolution originates from the acceptance of mere quantitative changes, it does not recognize compulsion, regularity in transformation, changes from one qualitative condition to another. But without the transformation of one qualitative condition into another, without the originating of new qualitative conditions from the depths of old conditions there is no development, but only increased or diminished quantity, only what is commonly called growth.

Darwinism confirmed in biological science the concept of the origin of some organic forms from others. Development in living nature was interpreted by darwinism only as ^acontinuous, uninterrupted line of evolution. As a result biological science (not practice) stopped considering species as real, separate, qualitative conditions of living nature. In his "Origin of Species", Darwin wrote: "It is evident from the above that I

consider the term 'species' altogether arbitrary, invented for convenience, to designate groups of specimens resembling each other and not distinct from the term 'variety' designating forms of lesser variations in their characteristics. The term 'variety' is equally applied arbitrarily, compared to individual distinctions, and is used only for convenience."

K. A. Timiriazev wrote on the same subject: "Variety and species are only distinct (differing) in time; any boundary is unthinkable."

Thus according to the theory of darwinism, nature should not possess natural limits and interruptions between species. According to this theory the development of the organic world is reduced to numerical changes, with no originating of new elements from the depths of the old, without further development of new qualities as other aggregates (asans) of characteristics.

This theory claims that a long stretch of time is required to obtain one species from another, that in the course of human history it is not possible to observe the inception of some species from others.

Organic nature has existed for a long time, however. One could therefore assume that the lengthy period of conversion from one species to another has been gone through and that it may be possible to observe the birth of new species in our time as the result of prolonged transformations. The theory claims nevertheless that there are actually no boundaries between new and old species from which the former originate. And that for this reason it is not possible to observe the inception of a new species from the facets of the old.

Contrary to the theory of continuity, which does not recognize interruptions in development, the conversion of one quality (trait) into another indicates that there are no boundaries between species and that such boundaries actually exist; every naturalist has been aware of these long ago. To

explain the break between species darwinism was compelled to invent the so-called intra-species competition and struggle. According to this theory all intermediary forms which supposedly filled the breaks between species, constituted thus an uninterrupted line in organic nature and were dropped as less fitted in the struggle for survival.

To smoothen the apparent non-conformity between the theory of evolution and the actual development of the vegetative and animal world, Darwin took recourse to the reactionary pseudo-scientific teaching of Malthus concerning intra-species struggle. This struggle is supposedly caused by the fact that nature always produces more individuals of one species than are warranted by available living conditions. Darwin used this as a basis for his theory of the divergence of characteristics, i.e. the formation of an uninterrupted line of organic forms of breaks, facets, as a result of which species of plants and animals, easily distinguished among their respective groups were supposedly obtained. Facets and breaks between related species were consequently, according to darwinism, obtained not as the result of qualitative changes (transformation) and not as a result of the concept of qualitatively new groups of organisms among species of plants or animals, but as a result of mechanical elimination, mutual destruction of forms, not differing in quality and adjoining each other in an uninterrupted row.

This accounts for the conclusion arrived at by all followers of the theory of flat evolutionism that SPECIES are theoretically not the result of a PROCESS OF DEVELOPMENT OF LIVING NATURE discovered by science and practice but are conventions invented for the convenience of classification.

The apparent contradiction between theory of evolutionism and actuality i.e. the development of organic nature, thus remained in existence. It is supported by the fact that darwinism was able to explain the development

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of the organic world only thus and in no other way. The explanation could not serve as a workable theoretical basis for practical transformation, was unable to serve as a theoretical basis for the planned transformation of living nature in the interests of practice.

The foremost biologist, K. A. Timiriazov, a fervent fighter against idealism and reaction in science, although unable to surmount the evolutionism in Darwin's theory in his lifetime, recognized clearly that species were not conventions but real factors in nature. He therefore wrote: "These facets, torn links of an organic chain, were not introduced into nature by men but were forced upon him by nature itself. This genuine fact requires a realistic explanation."

It was however not possible to provide such a realistic explanation from the standpoint of flat evolutionism, and K. A. Timiriazov himself confined himself to the incorrect Darwinist explanation of this fact as resulting from supposedly intra-species competition.

Only in our country where socialism is victorious, where the dominant concept is dialectic materialism, as developed in Stalin's works, real biological facts--SPECIES--were given the opportunity to provide a genuine explanation. Collective and state farm agriculture provides for unlimited development of materialistic biological science, i.e. Michurin theory of creative darwinism. I. V. Michurin wrote: "We have as yet no proper and exhaustive concept as to how nature has created and to this day continues to create innumerable species of plants. We are at present much more concerned over understanding that we have entered the stage of historical development in which we are capable to interfere personally in nature's activities and 1)ACCELERATE AND INCREASE THE NUMBER OF FORMS OF NEW SPECIES AND 2)ARTIFICIALLY DIVERSIFY THE STRUCTURE OF THEIR QUALITIES INTO DIRECTIONS

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FAVORABLE TO MAN. We should understand that working jointly with nature represents a very valuable step ahead, represents a fact of universal significance, that will become apparent in the future development of this work, to which impulse was provided by the powerful jolt of our revolution which awakened millions of Soviet minds, permitting a considerable part of the population to improve actively and deliberately surrounding life."

Michurin's teaching is creative darwinism which views development not as a flat evolution but as the concept of a new quality emerging from the depths of an outgrown contradiction of its origin, which suffered the gradual numerical accumulation of its characteristics and in the struggle with the old quality was transformed into a new, deliberately different aggregate of characteristics equipped with their own contrasting law for survival.

Dialectic materialism, developed and raised upon a new height (level) by the writings of comrade Stalin, represents the most valuable and power-
available to biologists and Michurinists, for solving
ful theoretical weapon ~~for solving involved biological problems by soviet~~
involved biological problems,
~~biologists and Michurinists~~ including the problem of the originating of
some species from others.

In nature as in agricultural practice there are always relative, not completely defined facets between species. We understand under relative but fully defined facets (border lines) such distinctions which allow for a difference in SPECIES and resemblance among species, separating organic nature into qualitatively distinct but nevertheless mutually linked SPECIES.

The uninterrupted row of forms between species as varied definite material conditions in living matter remains unrecognized not because continuously joined forms have become extinct as a result of mutual competition, but because there was not and cannot be any such continuity in nature. Nature does not possess uninterrupted continuity; both regularity and interruption go together.

A SPECIES IS A SPECIAL QUALITATIVELY DEFINITE (DISTINCT) COMBINATION OF LIVING MATERIAL FORMS. DEFINITE INTRA-SPECIES RELATIONSHIPS BETWEEN INDIVIDUALS REPRESENT A CHARACTERISTIC OF PLANT AND ANIMAL SPECIES AND MICRO-ORGANISMS. These intra-species relationships are distinct in quality from the relationships between individuals of various species. QUALITATIVE DISTINCTION BETWEEN INTRA-SPECIES RELATIONSHIPS AND INTER-SPECIES RELATIONSHIPS REPRESENTS ONE OF THE MOST IMPORTANT CRITERIA FOR DISTINGUISHING FORMS OF SPECIES FROM VARIETIES.

The statement that variety is the beginning of a species and that a species is a drastically expressed variety is wrong. In proceeding from this erroneous formulation it appears that there are no qualitative distinctions and facets between species and varieties and that a species does not realistically exist in nature but has been invented for the convenience of classification, systematics. Here, as has already been stated, is hidden one of the fundamental contradictions between the theory of flat evolutionism and the reality of an organic world. There are no intermediate varieties among species, not because these varieties were dropped in the process of an intra-species struggle but because these intermediate varieties were not produced by nature, nor will they be produced.

Varieties are forms of the existence of a given species and not steps directed to its transformation into another species. Wealth of varieties is ensured by the multiple ecological adjustment of a given species which contributes to its production and preservation.

The larger the number of varieties in any species, the more varied are intra-species populations and the better provided for are possibilities for the production of species and all its varieties, (i.e. by means of cross pollination).

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Intra-species relationships among individuals are, as stated above, distinct in quality from the relationships of individuals of various species. The concept of a species in biological science is therefore different in principle from other botanical and zoological concepts, such as genus, family, etc.

It is easy to note that relationships of individuals of various species of the same botanical or zoological genus fail not only to contribute to the development of given species but on the contrary, are in competition and antagonistic. In nature and agricultural science it is therefore usually difficult to find examples for prolonged co-existence in mixtures of individuals of varied but related species, i.e. of the same botanical genus. Coexistence is frequently observed among vegetative species but these are species distant from each other, belonging to different botanical genera. Coexistence among species of the same botanical genus is possible only when individuals of every species are distributed by "curtains", nests.

The concept of a genus in botany and zoology corresponds therefore not to common related bonds such as intra-species ties, but tells only of the immediate bond in origin of species of the same genus. The concept of a genus should characterize the morphologically related but qualitatively distinct species.

Individuals of different species of the same genus, despite their external resemblance, do not cross under ordinary conditions, nor do they provide after crossing normal fertile progeny, i.e. they are physiologically incompatible. In addition, the relationship of species of the same genus is, as stated above, competitive, mutually excluding.

Species are links in a chain of living nature, stages of qualitative isolation, steps in a gradual historical development of the organic world.

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tained in the past years from research on formation of species in the vegetative world supports this view.

Experiments made in 1948 by V. K. Karapetian disclosed that during winter planting of the hard wheat (28-chromosome), Triticum durum, one part of plants is transformed in relatively short time (2-3 generations) into another species, the soft, 42-chromosome wheat, Triticum vulgare.

Proceeding from the previously established Michurin biology of genetic difference in quality of the body of the Vegetative organism, it was decided to search for seeds of soft 42-chromosome wheat in stalks of hard wheat of plants under test. The result was that isolated seeds of soft wheat were easily found in stalks of hard wheat, i.e. seeds of one botanical species in stalks of another species. In planting seeds of soft wheat, T. vulgare, obtained from stalks of T. durum, plants of soft wheat, T. vulgare, were produced as a rule. In searching carefully it is possible to discover every year seeds of soft wheat among some stalks of hard wheat on ordinary industrial plantings in many regions.

In 1949 search for seeds of rye in stalks of wheat were begun on fields of pre-mountainous regions where plantings of winter wheat are frequently contaminated by rye. The initial cause for wheat contamination by rye in these regions has not been learned to date.

V. K. Karapetian, M. N. Yakubtsiner, V. N. Gromachevskii, as well as many other scientists, agronomists, and students discovered in fields of pre-mountainous regions isolated seeds of rye among stalks of both hard and soft wheats. In 1949 over 200 seeds of rye were found. These seeds were planted on the experimental field of the All-Union Academy of Agricultural Science, imeni Lenina, at "Lenin Hills", upon the initiative of the Institute of Genetics of the Academy of Science of USSR, and on fields of

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the N. A. Timiriazev Moscow Agricultural Academy. The All-Union Academy of Agricultural Sciences, Imeni Lenina also obtained from those regions unthreshed stalks of soft and hard wheat. These stalks were threshed at different biological scientific institutions and different individuals segregated seeds of rye.

In planting these seeds of rye, developed in stalks of hard and soft wheat, diverse but nevertheless typical for rye plants were developed with small exceptions. Only in isolated cases were wheat plants obtained from rye-type seeds. In all above listed cases where seeds of one species were found in stalks of another, the plants themselves, as well as their stalks could not be included in some intermediate forms on the basis of external characteristics. They were typical, ordinary stalks of hard and soft wheat. The internal condition of these wheat plants was, however, no longer common or uniform in quality with regard to species. This is proven by the fact that these wheat plants produced not only seeds of wheat but isolated seeds of rye, i.e. seeds of another species.

In 1949 the Lenin Agricultural Academy also received a specimen of oats in the panicle of which, along with seeds of oats, were isolated seeds of "ovsniq", Avena fatua, i.e. Avena sativa had produced isolated seeds of another species, Avena fatua.

Instances of findings of Avena fatua in pure strains of oats have been repeatedly reported in domestic and foreign literature.

In producing branched wheat Triticum turgidum on the experimental fields of the Lenin Agricultural Academy, as well as in several other places, contamination by mixtures of soft and hard wheat, oats, 2-and 4-row barley, as well as spring rye were observed in plantings of wheat. Our observations led us to the conclusion that the primary source for the appearance of these

mixtures is the branched wheat Triticum Turgidum itself.

In 1950 plants of barley representing mixtures in plantings of branched wheat, T. turgidum, showed that they had developed from seeds which in outward appearance did not differ at all from seeds of wheat T. turgidum. The supposition has been repeatedly made in practice concerning the transformation or regeneration of one species of various agricultural plants into another, such as for instance the transformation of wheat into rye. The problem had given rise to a lengthy discussion in our national literature in the first half of the past century.

Cases of the transformation of hard wheat into soft wheat or the transformation of hard and soft wheats into rye are apparently not new. The above new facts, however, were obtained deliberately or disclosed by deliberate search.

Part cases had consisted in the following: Isolated plants of soft wheat were found among plantings of hard wheat; these propagated more and more in further planting, gradually displacing hard wheat. Similarly, among plantings of winter wheat isolated plants of rye were observed. In subsequent plantings of seeds from yields of these fields rye propagated rapidly and dislodged wheat. All these instances of discovering some species of vegetative forms in plantings of other species scientists refused to regard as results of the transformation of one species into another. Valid doubts were always presented. It was not established whether the primary cause of this contamination was a common, frequently observed mechanical mixture. There was no assurance that among original seeds there had not been any isolated seeds, mixtures of another species. No assurance that in the field of planting, seeds of other species were not carried over by water, wind or birds. No assurance that seeds of mixture species in a given planting had not been in the soil for a long time, etc.

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This explains why on the basis of past cases it is not possible to prove that primary sources for various mixtures and several contaminants of plantings, aside from mechanical introduction, may also have been originating vegetative forms of one group of species from other species.

All enumerated arguments against the inception of other species may be rejected with regard to the above current test. Isolated seeds of rye, discovered in stalks of wheat which had grown for several generations under definite conditions, can actually not be attributed to introduction by birds, man or any other means. These seeds were produced by wheat plants and had developed in wheat stalks.

The supposition of the hybrid origin of seeds may be equally rejected. It is known that wheat may be crossed with rye, though this occurs seldom. In those cases a definite rye-wheat hybrid is obtained which in external appearance is easily distinguished from both wheat and rye. In addition, rye-wheat hybrids are, as a rule, self-sterile, do not produce seeds, and may produce these only if pollinated with the pollen of one of the parents, preferably wheat. In the above case seeds of rye derived from stalks of wheat produced ordinary plants of rye of normal fertility. They did not exhibit any hybrid characteristics. The same may be said concerning the rest of facts mentioned above.

The examples we mention concerning the originating of some species by others are valuable because analogous facts may be observed on corresponding fields in any year. These facts may also be obtained by growing plants on special fields under experimental conditions.

Factual data obtained up to now concerning the formation of species applies to the vegetative world only. Necessary data on the process of formation of species in the animal world is lacking so far. It is nevertheless,

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entirely possible that the development of Michurin's biological theory will soon furnish provisions for assembling factual data, analogous to that of the plant world but applied to zoological objects.

Material available on the subject of the formation of species in the vegetative world provides ground for the belief that several existing plant species (if not all) are capable of producing anew other species at present and are frequently producing them under suitable conditions. The same vegetative species is capable of producing different related species. Thus hard wheat, Triticum durum, may produce soft wheat, T. vulgare, and also rye, Secale cereale.

Changes in an external environment, essential for specific species of given organisms, are sooner or later forced to change their specific characteristics and as a result some species will produce others. Under the influence of changed conditions that may have become unfavorable for the nature (heredity) of organisms of growing plants species, germs of the body of other species are originated and formed in the body of species conforming better to changed external environments.

Such variation in quality in the body of the same vegetative organism, characteristic of different species, can in some instances be observed with the naked eye. Facts of multiple originating of some long existing species from others is also explained by the emergence of varietal distinction in quality in species under the influence of corresponding external environments. If plants of a given species, in some manner or other, get into conditions relatively unfavorable for the normal development of their specific characteristics as species, a forced transformation (change) takes place, i.e. the originating in the plant organism of a given species of germs of another species, the characteristics of which are better suited by

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the new environment.

The production of isolated specimens of another species within the old species, to meet conditions better, leads to rapid propagation and the capacity to dislodge under these conditions the species from which they originated. If this occurs in nature, the originated species completely dislodges the old species in that area by rapid propagation.

The situation is different in agricultural practice where cultivated plants are protected from weeds by cultural methods.

Science has known for a long time that many species of weeds exist only in agricultural practice; under natural conditions there are no such species, nor are they able to exist there. Thus if a field contaminated by many species of weeds is left fallow, it will over a period of time, after some 20-30 years, i.e. rather soon, be completely cleared of many species of weeds. Such a field will no longer produce species of weeds but other species peculiar to ordinary virgin and uncultivated plots of that region.

Species of weeds are products of some existing species in nature, as are cultivated plant species; for instance the most harmful weed "ovsuig", Avena fatua, may be produced by oats.

No species of plants peculiar to virgin soil will find suitable conditions for its normal development on plowed land. The species formerly grown on virgin land will therefore sooner or later, change into other species better adapted to conditions created by soil cultivation. This applies equally to cultivated plants when they happen to get into unsuitable climatic and agro-technical conditions. They will slowly or more rapidly, but invariably transform into other species to meet prevailing conditions.

Some species of weeds have been cultivated long ago. Thus rye, originating under certain conditions from wheat, acts as the most and

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weed by dislodging wheat from fields. In such regions special methods are applied, i.e. cultivating and thinning, cleaning of wheat seeds from seeds of rye and generally protecting wheat from being dislodged by rye. In other regions rye has been introduced as a crop. This also applies to soft wheat which frequently originates from hard wheat and in such cases acts as contaminator. Hard wheat is protected by cultivating seed plantings. Soft wheat has been introduced as a crop long ago.

Many other species of cultivated plants equally originated from other species of culture crops. This explains why it has not been possible to find wild initial species for many cultivated plants.

Poor agricultural practices that do not establish necessary good conditions on fields for cultivated crops deteriorate the nature of these plants with regard to yield and lead to the impairment of its quality. Simultaneously, poor agricultural methods contribute to the development of a variety of weeds, seeds and other germs of which are in the soil or are carried in with poorly cleaned seed stocks.

Finally poor agricultural practices may also create conditions for originating isolated germs of many weed by cultivated plants.

The establishment of initial sources for species of weeds and the disclosure of environmental conditions determining such origin represents one of the most important tasks in agronomic biology. Scientific work applied in this direction will not only facilitate weed control on fields where weeds prevail but will permit the elimination of the possibility for producing some species of weeds from other weeds and cultivated plants.

By creating new conditions for organisms or eliminating the influence upon them of existing conditions in an external environment it is possible to establish new plant species useful to agriculture and prevent the

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development of weed varieties harmful to our economy.

Therein lies one of the practical and important tasks requiring theoretical study, the problem of the formation of species; it is far from being the only one.

End of Article

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Topchiev, A. V. Fundamental results
of the scientific activity and of the
introduction of completed research of
the Academy of Sciences of U.S.S.R. for
1950. Akad. Nauk SSSR. Vest. 21(3):38-65.
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Transl. 221:Institutions

Excerpts translated by S. H. Munson

(The author is chief scientific secretary of the Presidium, Academy of Sciences of the USSR. This report presented at meeting of Feb. 2, 1951)

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With regard to the complex problem on "Obtaining high and stable yields", the Institute of Plant Physiology, named K. A. Timiriazov, developed and introduced into practice an effective method for curtailing the growth of potato tubers in storage, a measure which reduces the loss in tuber weight during prolonged storage by 3-6 times.

A new method was developed to prevent the drop of cotton bolls, which raises the yield an average of 25%; it passed the industrial test.

With respect to "Caoutchouc and guttapercha", the Botanical Institute created new highly productive forms of rubber bearing plants.

The vast and useful work performed by the Botanical and Soil Institute jointly with other institutions in compiling soil, geo-botanical maps and other data deserve mentioning.

In line with the above achievements, it is necessary to point to some substantial deficiencies in the work of some departments.

The Zoological Institute did not complete the fourth volume of the handbook "Animal World of USSR", nor was the field work on the subject "Insects injuring seeds of cultivated clover and alfalfa" performed. This equally applies to work on silkworms.

AM-8-27-51

Konstantinov, P.N. More attention to be given to experimental work. Sovet. Agron. 4(7):11-18. July 1946. 20sp84

Translated from the Russian by S.N. Monson.

(The author is an active member of All-Union Academy of Agricultural Sciences, imeni Lenina)

The USSR has accomplished a great deal in agricultural experimentation but the work requires further improvement. The entire complicated system of experimental institutions, subordinated to various ministries and their respective administrations which are haphazardly distributed throughout the territory of the Union calls for fundamental reorganization.

The enormous network lacks unified scientific and operative supervision. Distribution of these institutions is most irregular throughout the country and while planned production requires complex experimental institutions, superfluous specialization is frequently the case (cereals, cotton, sugar beet, etc.) The lack of coordination in subject matter, contradictions and detachment from demands of agricultural production are noted in practical actuality. They reflect upon the expediency of the work of agricultural experiment institutions, lead to delays in solving actual problems and unproductive expenditures. Many institutes are known to undertake unnecessary studies, such as VIR studying problems of mechanization.

The Odessa Institute of Genetics and Selection also studies mechanization and planting of winter wheat on stubble.

Institutions frequently duplicate work and interfere with each other, with the result that they are known to advertise all kinds of "discoveries" of things long discovered. Specialized institutes, such as the Institutes of Flax and Hemp Industries, and recently the Institute of East Crops, may have need for subjects like mechanization and even the construction of machinery (who but a plant grower is better equipped to observe details in this narrow field?), but in similar instances these institutes should

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provide regular sections in mechanization. Selection stations are devoting scant attention to agricultural techniques; in some places old and prolonged rotations of crops were discontinued. Essential problems in agricultural methods are usually overlooked.

Many objectionable features in programs of research institutions could be enumerated. The establishment of a single scientific and operative center is imperative for purposes of unifying the activities and increasing the expediency of the work of agricultural experiment institutions.

The All-Union Academy of Agricultural Sciences, imeni Lenina, should become such a center. This will call for the transfer of all agricultural experiment institutions of the various ministries to VASKHNIL. The latter should equally supervise the work of scientific-research agricultural VUZY (higher educational institutes). The role of agricultural VUZY in the experimental field must be stressed. VASKHNIL should in this connection organize the following departments:

- a) a department of agricultural reorganization with sections of economics and organization of agricultural production; sections of natural sciences (soil, climate, flora); crop rotations; distribution of agricultural production with the following sub-sections: distribution of agricultural crops and of varieties of domestic animals.
- b) a department of agriculture with sections of irrigated and non-irrigated agriculture (agro-chemistry, selection, agricultural meteorology), plant protection, microbiology;
- c) a department of husbandry with sections on species of domestic animals, and a veterinary section;

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- d) a department of forestry;
- e) a department of vegetable and fruit growing;
- f) a department of agricultural mechanization with sections for use of machinery, repair, regionalization of agricultural machinery, equipment, planning and development of new machinery.

VASKHIL should also be given control over many institutes of the nation's academies: the Botanical Institute, the Institute of Genetics, Institute of Microbiology, and the Institute of Agricultural Soil Science.

The entire territory of the USSR should be divided into an adequate number of economic and natural zones. It seems feasible to consider the establishment of some 24-26 zones. Among them 2-3 non-chernozem, 8 chernozem, 3-4 forest-steppe, 3 Siberian, 4 zones of dry agriculture - (dark chestnut soils, chestnut soils, light chestnut soils and solonchaks soils); 2 sub-tropical zones; 1 zone for Central Asia, 1 for the Far East, etc.

All agricultural experimental institutions in every zone should be placed under the supervision of the major experimental institution in their zone (zonal institute or oblast' agricultural experiment station) where a zonal scientific council should be set up. The central link of the network should be represented at republic, krai and oblast' complex experiment stations, where departments on agricultural economics and the organization of agricultural production, mechanization, soil science, meteorology, chemistry, etc., should be set up or strengthened. These large stations would cooperate closely with local land institutions and supervise the work of regional stations and fields, and the lower network (KIS, cottage laboratories). No other experimental institutions should conduct experiments on agricultural production above the planned lower network.

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Selection station of SORTUPRA (varietal administrations), together with other stations should be transformed into complex stations. No good selector or agro-chemist will lack knowledge in agro-techniques. Economics and agricultural practices represent the basis for everything. The predominating role given selection as a subject matter at several large stations is permissible, superfluous specialization at many agricultural experiment stations should, however, be done away with.

Agricultural VUZY should head the work of large research institutions (institutes, oblast' stations, MTS.)

Experiments on varieties of all crops should be united under a single government commission of varietal testing, to be attached to the Council of Ministers of USSR, with separate sections on cereal, technical, forage and vegetable crops. An institute for varietal testing and regionalization of agricultural crops should be organized. The same institute should deal with problems of agricultural regionalization and distribution of agricultural crops in cooperation with VASKHNIL and with a council whose function it will be to study the productive (creative) capacity of AN (Academies of Science) of USSR.

The most expedient arrangement in subject matter at the upper, central and lower links of research institutions is possible only when agricultural regionalization of USSR and the productive specialization of separate zones and macro- and micro-regions will be determined.

The accomplishments and deficiencies of the two-year expedition of the brigade of NKZ of USSR, made under my supervision, which dealt with the distribution of agricultural crops in Siberia (1941-43), as well as my familiarity with the work of concrete experimental institutions support this view.

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The enormous economic significance of the proper distribution of agricultural crops is hardly subject to controversy, provided this distribution will take into account the demands of industry and the economic and natural characteristics of separate zones, oblast(s) and regions in individual areas. Inadequate operation of planned crop rotations testifies also to their inadequacy on farms. At 30.5% of collective farms in the East, given crop rotation schedules, only single percentages or parts of percentages met these requirements.

Complex agricultural regionalization creates maximal clarity in subject matter at scientific research institutions. It permits segregation of perspective and rejection of all incidental subjects that do not meet current needs of local agriculture. It determines the distribution of labor among research institutes, oblast' and regional stations, and simplifies generalization and the effective use of the enormous scientific material, both old and new. The administration of work planned for the lower network (MTS, cottage laboratories) will also be helped.

Proper regionalization may, nevertheless, be accomplished only in the event that some of the major local research institutions, in collaboration with VASKHIL, will independently carry out agricultural regionalization in their zones according to plan. Sections in agricultural economics, studying jointly with planning organizations the general problems in agricultural economy, the organization of agricultural production, labor, etc., should be organized at every one of these institutions. They should provide for the economic evaluation of typical crop rotations at their respective zones of individual agricultural methods and crops, provide

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for the proper distribution of agricultural crops and domestic animals, regionalize agricultural methods in their zones, etc.

We are familiar with the principles of plant growing in crop rotations and are almost unfamiliar with their economic basis. In planning for crop rotations at any region from an economic standpoint, we would aid and provide for a closer agronomic foundation. Economic and plant industrial bases for crop rotations are inseparable; they supplement each other. Economic considerations should be leading, however, a circumstance frequently overlooked.

Wherever possible it is also necessary at present to introduce schemes of typical crop rotations to meet the direction indicated by local economy and to appraise their relative value. Such crop rotations should have appropriate sectors on plots in order that general equipment and machinery of a heavily mechanized farm can conveniently be used for soil cultivation, planting, care of crops, weed control, harvesting. Crop rotations may be also organized outside of the territory of the institute or station.

Economics of crop rotation may be studied at available large farms where crop rotation is practiced. It is imperative to stress the critical evaluation of planned crop rotation and its introduction into industry. It is also essential to devise schemes for the study of predecessors, bearing in mind that without crop rotation proper agricultural practices, cultivation, introduction of fertilizers, weed and disease control and effective selection are not possible. One should not be content with a situation where nurseries of initial material for selection of field crops are distributed on a variegated (randomized?) plot located on the outskirts and away from crops under rotation.

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Agricultural regionalisation requires intensification in the study of soil science and agricultural meteorology on the territory of the institutions themselves, as well as on territories of the zones they service. The hydro-thermic program has to be practiced directly on sectors of crops under rotation, with established rain-gauges, a variety of thermometers and evaporators in the fields.

The study of pure-stand plantings and grass mixtures in geographical cross section is acute, so is the cultivation of their layers and turnover, layer plants, the cultivation of hard and soft wheats on hard and soft soils. Soil structure is closely connected with this problem, its agronomic significance, the possibility of increasing the structure of the soil by cultural treatment, the introduction of fertilizers, etc.

It is high time we detached ourselves from the hypnosis of the predominant significance of grass mixtures with regard to pure-stand plantings of grasses. Their careful study in a geographical cross section will without doubt refer to their diverse agronomical significance.

Thus in dry regions of extensive agriculture (dry steppes primarily) in grass field crop rotations, where grasses are used for a prolonged period (5-6 years), grass mixtures play an important role in controlling field contamination and a lesser role as reconstructors of soil structure. Despite the enormous significance of grass planting (grass mixtures, pure-stand plantings) this has unfortunately been inadequately studied in geographical cross section. Experimental data on the relative expediency of pure and mixed grass plantings in geographical cross section is very scarce.

Mechanization of crops and varieties in geographical cross section has also received inadequate study. Thus, according to Professor Yakuba,

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it would prove expedient to devote attention to several problems:

- a) adjustments for deep soil cultivation (fore-plow and its construction; soil digging machinery - methods and depth of cultivation of furrow depth; two-row plows; deep plowing, methods for their use and equipment; hard-pan breakers and mole-drainage);
- b) deep cultivating without turning over of layer; chiseling to substitute for spring plowing;
- c) control of crust;
- d) rolling of soil in geographical cross section; rakes of the rolling type;
- e) narrow-rowed, combined and nest-like seeders, one-grain seeders with different attachments for planting grain and small seed crops;
- f) equipment for inter-row cultivation and plant feeding;
- g) harvesting machinery (among them those with small reach for experimental stations); universal use of combines; adjustments for harvesting lodged grains; special harvesting machinery;
- h) threshing machinery for special crops;
- i) sorting machinery and selection of sifters.

It is understood that expediency in mechanization, agricultural technique and soil science will be highest when these phases will be closely correlated.

The solution of the problem of optimal programs for storing selected varieties of different crops is urgent. The study of physiological-biochemical characteristics of every variety under optimal and ordinary industrial programs of storing must be given careful study. The influence of the origin of seeds of the same variety, storage program, the physiological-

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Biochemical characteristics of seeds upon yield are enormous. Difference in yields may amount to 40-60-80%. Standards for planting qualities of seeds should include these new points.

METHODS OF AGRICULTURAL EXPERIMENTAL WORK

Methods for precise laboratory experiments (objects of special laboratories) have been more or less set up. The establishment of vegetative tests with various living organisms on specific substrata is more complicated. Here extreme care is essential. The choice of a plant for experimentation ensures accuracy in conclusions. Field experiments are still more complicated. Correct results are determined by basic factors: the object under test, optimal agro-technique, optimal and maximal compression in space and time. Accuracy in conclusions is ensured by the selection of a uniform variety. This is usually a regionalized variety. Accuracy in conclusions is also ensured by a typical and even plot, with respect to its predecessor, by relief, hydro-thermic program, uniformity in soil cultivation, planting, care, harvesting, establishment of type of equipment and machinery. Severe contamination and differences in degree of contamination, disease infestation distort results considerably. Accuracy in conclusions is also ensured by typical conditions throughout the year and the individual seasons of the year, as well as the most important periods of vegetation, the stages and phases of development, the type of plant under test. Next come types of seed qualities in planting material: physiological maturity of seeds, purity, germination, metabolism, absolute weight, norm of planting, origin of seeds; typical development of ento- and phyto-pests, etc. The ability to typify conditions of the environment.

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The very list of numerous factors that ensure accuracy in conclusions alone speaks volumes concerning the enormous complexity of methods in field experiments. A good experimenter must be capable of analyzing the multitude of conditions facing him while he conducts his experiment. He must also possess the ability to generalize broadly and synthesize the data secured and be able to analyze it.

The problem of typical years in their entirety, parts of years, etc., confronts the experimenter with difficulties. It is important to develop a method for "typifying" years and certifying data. It is not possible to trust any accidental figure or stereotype averages derived occasionally from very variable data of repeated occurrences.

Here the experimenter will be confronted with an entire series of disciplines on general knowledge and supplementary special disciplines: Marxism, Leninism, soil science, meteorology, agro-technique, plant industry, agro-physics, microbiology, agro-chemistry, selection, physiology, phytopathology, entomology, mechanization, botany, etc.

An experimenter must be well supplied with diverse knowledge. The road to knowledge leads, however, through systems and methods of study. Methods of the agricultural experimental field indicate stages and ways for the acquisition of entire groups of supplementary sciences. An experimenter should, in addition to his narrow specialty, possess a knowledge of many agronomic sciences, agricultural economics, the organization of agricultural production. He should know soils well and the climate of the territory of his experimental institution, his region, should possess a clear general idea of the soils and climatic zones of the Soviet Union. The experimenter should, I repeat, be a good agro-technician, since without agro-technique there can be no effective work done in agro-chemistry,

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selection, plant protection, etc. The ecology of agricultural plants and diseases should command his particular attention. He should always remember that field tests must be conducted under conditions of modern improved mechanization, a circumstance equally not appreciated, especially in studying economics and productivity of crops under rotation. The actual industrial condition in mechanization should, nevertheless, not be overlooked.

All this does not preclude sensible specialization and differentiation of labor among specialists of experimental institutions. These should well prevail. Scientific coordination between scientists is however possible only if both specialists know each other's subjects well. The work of an experimenter will acquire greatest expediency under circumstances where close collaboration is established with related laboratories, where an experimenter shares his topics and ~~results~~ ^{confers} most frequently with the entire group.

Isolated work of experimenters - selectors, working on winter and spring wheat, winter wheat and rye-wheat hybridization, Agropyrum-wheat hybridization, the production of perennial wheat, etc., may serve as examples of objectionable parallelism.

The above calls for the revision of subject matter at allied laboratories and for the establishment of necessary contact in their work.

In the light of the above, the complexity of factors of external environments as they reflect upon results of field experiments, endless talks concerning supposedly universal methods of conducting field tests, the size of plots and their replicas, without regard to the object under test and conditions of environment, appear positively negligible. Questions such as, "what is better - large or small plots? 2-10-12 replicas?"

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Under optimal testing conditions duplication may be preferable to 10 replicas under non-optimal conditions, i.e. under very irregular, dissimilar natural background and poor cultivation of the soil. There is no optimal method according to regions as yet. In some instances men without a trace of embarrassment take plots of 36 m^2 under three replicas in regions of variegated soils. The results are not comparable, as may be expected.

The second point to be considered is multi-variation of tests. Even at zonal institutes tests are shamelessly conducted in 30 or more variants on variegated backgrounds. The optimal number of variants should be made more precise (specific) in different schemes depending upon zones. The third point concerns the application of mathematics in processing experimental data. Who only uses it and in what manner? It is applied in processing both valid and invalid observations. An agronomist-experimentor, poorly versed in mathematical fine points will frequently evaluate correctly the results of his labors from an agronomical standpoint, will reject one variant, give a positive appraisal to another. While any mathematician will tell him that either all tests are valid, or all invalid, depending upon the correlation of the number of good and poor variants in the test. The so-called average single generalized error in tests (standard deviation?), obtained from foreign sources, proves a veritable scourge, especially for young beginners-experimentors.

It is true that some agronomists-experimentors have no desire to yield to genuine mathematicians. Here or there one may come across a method with specific (precise) indicator, either "Izofiria" or Iambic or dactylic method (Moller-Arnold), Kostetskii method, etc. Well, all in all, competition between agronomists and mathematicians deserves better application.

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Distortions in applying mathematics in processing test data continue. In order to remedy the situation I decided in 1941/2 to recall the ancient grandfather method of ordinary processing and evaluation of experimental data to experimenters in my article on variety grouping. To overcome distortions in results of tests with regard to irregularity and variation in fertility of soils is one of the major problems in field experiments. The comparability of test variants of varieties in varietal tests, as well as the correctness of their grouping, depend upon the degree to which this influence may be eliminated. The effect of irregular, frequently chaotic variation in soil fertility, according to zones, covers up all actual distinctions among varieties. The properly conducted "pairing" method, as recommended by me, raises comparability, while neglect in this instance will frequently wipe out its advantages.

The attempt to find a method for grouping varieties, not according to actual yields, which frequently differ in individual replicas, but according to less variable, more constant characteristics, is therefore warranted and plausible. It may be the place occupied by a variety with regard to its rank in yield or a test in each replica, more or less uniform with respect to soil cover, relief, contamination, etc. The tendency of better or poorer varieties (variants) to occupy within the limits of individual replicas the best or poorest places in yield is more constant and less subject to variation than are actual yields. If therefore ten groups will indicate within the limits of every replica their rank in yield, the derivatives of elementary rows of rank orders for each variety (variant) and all replicas will, provided superior treatment is applied, be less variable. Grouping of correlation (in percentage) of every

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variant from the standard would be still better. Poor results are obtained from three replicas at 100 sq. m. and less.

In conclusion I wish to limit myself to a few good wishes to research institutes and largest agricultural experiment stations.

1. Assign unification of the scientific method of supervising all experiment institutions to the reformed All-Union Academy of Agricultural Sciences and consider it connected ^{with} ~~by~~ the Council of Ministers of USSR.
2. Eliminate "dualism" (duplication) in the administration of experimental institutions on location. The director should be also its scientific supervisor. A well qualified scientific supervisor may be only someone who is in charge of personnel and funds. This will increase the sense of responsibility of the director for the entire organization. An aide should be assigned to deal with economic-administrative duties, and a scientific council organized at the directorate level.
3. Organize sections of agricultural economics and organization of agricultural production in 1946, where there are none. Where these are available, their work should be strengthened.
4. Organize in this connection, study on the productivity and economics of crop rotations, as they exist in large mechanized agricultural industrial units, as well as at those newly established on the territory of the experimental institution or beyond its typical rotation of crops, using modern mechanized agricultural production methods. Study the cause of inadequate application of scheduled crop rotations.
5. Intensify the study of soils and climate and their regionalization.

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6. The existing organization of scientific sections and laboratories of experimental institutions should be reviewed again from the standpoint of proper differentiation of labor and cooperation in work, as well as complexity in subject matter.
 7. Provide subject matter for new sections and make more precise that of present sections in this connection.
 8. Intensify the study of mechanization by organizing a network of machine-testing stations.
 9. Process the method of agricultural experimental work and method of field testing, as based on this data.
 10. Organize their scientific certification through the All-Union Institute of Agriculture by introducing agricultural methods and other achievements into industry.
- Organize the work of agricultural regionalization and the distribution of agricultural crops in a serviced region; the "typifying" and regionalizing rotation of crops; distribution of varieties, agricultural methods, animal genera, etc. All these projects should be coordinated with planning organizations and VASKHNIL.

End of article.

Pokrovskii, E. A. New preparation
for the control of injurious insects.
Sovet. Agron. 5(1):90-93. Jan. 1947.
20 So84

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A New Compound in Controlling Harmful Insects

The author is a candidate of Biological science.

Hexachlorocyclohexane or benzohexachloride ($C_6H_5Cl_6$) is obtained as a result of photochemical chlorifying benzole with the illumination of reactionary solution of actinic rays.

The method of a constant countercurrent of the photochemical acquisition of hexachlorocyclohexane has been worked out at the Institute of Fertilizers and Insecto-Fungicides.

The compound represents a mixture of isomers of hexachlorocyclohexane; alfa, beta, gamma and delta and of other substances which are formed during the process of chlorifying benzol.

The preparation of hexachlorocyclohexane consists of four simple operations.

The simplicity in preparing it, the possibility of a fast mass output and the low cost will promote its wide expansion.

At the entomological laboratory of the Institute the following application of hexachlorocyclohexane was studied: for the treatment of fruit trees and of berries before the spring budding, as an insecticide of contact and intestine effect, and for dusting grains.

Besides toxicological testing of hexachlorocyclohexane upon insects, experiments were carried out with aiming to explain phytocide qualities (plant burning).

For a more thorough study of hexachlorocyclohexane, the institute sent the compound for testing to the Moscow station for plant protection, to the All-Union Institute of Oil-Plants, to the All-Union Institute of Tobacco and Makhorka Industry, to the Voronezh Oblast' Agricultural

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Experimental Station and into the Laboratory of the Botanical Garden of the Academy of Sciences of USSR.

Hexachlorocyclohexane was tested in the form of five- and seven percent dust. Its effect was compared to the effect of a five percent dust of dichlorodiphenyltrichlorethane (DDT, compound "Gesarol") which is an insecticide of high effectiveness and which is applied in various ways.

Besides the dusts of hexachlorocyclohexane and diphenyltrichlorethane, the insects under experiments were sprayed with talcum in order to determine the effect of the filler without the active ingredient.

Each variant of the experiment was repeated at least three times, with three repetitions in the experiment.

For the experiments of early spring treatment, before the opening of the buds, were taken apple-trees which were infested by eggs of apple sucker [Psylla mali] and graftings of black currant which were abundantly covered with thorax of spotty scale under which its eggs winter.

The experiments with eggs of apple sucker [Psylla mali], carried out in laboratory and in orchard, indicated that neither hexachlorocyclohexane nor "gezarol" kill the eggs, i.e. they are not ovicides. The amount of dead eggs upon branches treated with dusts hardly surpassed the amount of dead ones upon control branches.

Both compounds, by killing the sucker larvae which grew from the eggs, reduced the infestation of apple buds by half. But the effect of both compounds is hardly sufficient, if we compare it with the effect of the compound Selinoi-nei especially intended for early spring spraying and which cleans the buds from the larvae.

The seven- and five percent dusts of hexachlorocyclohexane and

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"gezarol" did not kill the eggs of the spotty scale which were wintering under the thorax.

During inspection, 15 days after the birth, there were very little of living larvae which develop normally and which form thorax. There was a great amount of larvae upon the branches which were not treated at all or treated with talcum.

The compound "Selinon-nei" which contains "dinitrokrezol" in the concentration of 1 percent caused a complete destruction of the eggs.

The compound dichlorodiphenyltrichlorethane which is applied as an emulsion "Lauzeto" at the concentration of 1 percent did not kill the eggs of the scale, but later on it caused complete destruction of its larvae. Obviously, it is necessary to find a method of applying hexachlorocyclohexane for early spring sprayings in the form of emulsions.

As a contact insecticide, hexachlorocyclohexane was tested under the conditions of laboratory experiment upon four species of aphids: cherry, apple, cabbage and chrysanthemum. The registration of the experiments was done after twenty-four hours. The results are given in Table 1. (page 44)

Hexachlorocyclohexane was in all cases highly toxic, causing complete destruction of all aphid species. The high effect of hexachlorocyclohexane upon aphids makes it superior to dichlorodiphenyltrichlorethane.

The Institute of Tobacco and "Makhorka" Industry tested the dust of hexachlorocyclohexane in controlling peach aphid which is very harmful to tobacco plants.

During experiments which were carried out by repeating twice upon 664 insects under laboratory conditions, the 5 percent dust of hexachlorocyclohexane with the consumption of 50 kg/ha resulted in the 95.6

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Table 1

Table 1

Aphid species	compound consumption (in kg/ha)	Aphid destruction from compounds. (in percent)			Aphid destruction (in percent) during control experiments
		5 o/o dust RChCH*	7 o/o dust RChCH*	"Gezarol" 5 o/o DDT	
Cherry aphid.....	10	94	100	92	Control.....60/o
	20	95	100	90	Talcum 20 kg/ha.....120/o
	40	96	100	91	Nicodust 5 o/o 20 kg/ha.....920/o
Apple aphid.....	10	100	86	87	Control.....80/o
	20	99	98	97	Talcum 40 kg/ha.....440/o
	40	100	99	96	Nicodust 50/o 20 kg/ha.....960/o
Cabbage aphid.....	20	92	---	56	Control.....60/o
					Talcum 20 kg/ha.....190/o
					Nicodust 50/o 20 kg/ha.....880/o
Chrysanthemum aphid.....	10	69	69	49	Control.....10/o
	20	73	80		Talcum.....0.70/o
	40	86	94		

*Hexachlorocyclohexane

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percent destruction of the pest on the third day, 99 percent on the sixth day--and on the eighth day--complete destruction, in comparison to the 2.5 percent of the aphid mortality upon control plants. A ten percent dust of hexachlorocyclohexane caused complete destruction of the aphid during the same time, but on the third day after spraying already 93 percent of destruction has been observed.

In comparison with the compounds of dichlorodiphenyltrichlorethane, hexachlorocyclohexane demonstrated higher toxicity upon both the larvae and the mature insects of peach aphids. Thus, while the compound "gesarol" caused 100 percent of aphid destruction on the thirteenth day after treatment, hexachlorocyclohexane caused complete destruction under the same conditions and the same concentration on the eighth day. Hexachlorocyclohexane and dichlorodiphenyltrichlorethane affected the tobacco aphid comparatively slowly. The elucidation of the duration of the compound's effect indicates that dichlorodiphenyltrichlorethane is more resistant and maintains its toxicity longer than hexachlorocyclohexane. But the resistance manifested by hexachlorocyclohexane and long maintaining of toxicity, at least for two-three weeks, which is not natural to any of the insecticides of contact effect whose activity usually is limited to a few hours which requires direct effect of the compound upon the insects during spraying.

The same institute tested hexachlorocyclohexane as a contact insecticide upon tobacco thrips [onion thrip, Thripidae tabaci]. A five percent dust of hexachlorocyclohexane caused the destruction of 98.6 percent of larvae and 100 percent of mature insects after 24 hours; a ten percent dust caused a complete destruction of the pest after 24 hours. Five percent dust of dichlorodiphenyltrichlorethane caused 93.5-95 percent of larva destruction and 97-100 percent mature insect destruction after twenty-four hours.

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According to their toxicity upon tobacco thrips, hexachlorocyclohexane and dichlorodiphenyltrichlorethane proved to be of equal value, but they were by far superior to the most effective insecticide of contact effect-anabasinesulphate. The 5 percent dust of anabasinesulphate mixed with kaolin caused after twenty-four hours the destruction of 42.3 percent of the larvae and 55.5 percent of the mature insects.

The plants were not harmed by the spraying with hexachlorocyclohexane, but the tobacco was not good for smoking.

Hexachlorocyclohexane dust demonstrated high effectiveness upon grass bug [Lygus pratensis] which is a serious pest of oil plants.

Experiments proved that the mortality of the bugs reached 90 percent after the application of 5 percent hexachlorocyclohexane dust or "gezarol" with the consumption of the compound in the amount of 20-30 kg/ha. During the experiments which were carried out with the intention of burning plants, the dusts of hexachlorocyclohexane and of gezarol, even with the consumption of 100 kg per hectare did not cause any burning upon the plant.

Thus, the testing of the hexachlorocyclohexane dust, as a contact poison upon the insects with sutorial quality, proved high and resistant toxicity of the compound.

Hexachlorocyclohexane proved to be high effective during the experiments with rice weevil [Calandra oryzae] by dusting wheat grain (100 g. dust to a ton of grain).

The grain was thoroughly mixed with the compound for thirty minutes, and then the weevils were placed upon them. Five percent dust of hexachlorocyclohexane caused full destruction of the weevil after three days, and 5 percent dust of "gezarol"-after seven days. Talcum in the amount of

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1:1500 of grain after seven days caused only 5 percent of the destruction of the weevil. With the control plant there was no mortality of the weevil. There is some reason to assume that hexachlorocyclohexane affected the weevil as a fumigant as well.

At the Moscow Station of Plant Protection analogous experiments were carried out with grain mites [Tyroglyphus farinae]. The results are indicated in Table 2. (Page 8)

In controlling mites a greater amount of the compounds were consumed than in controlling rice weevil, whereby hexachlorocyclohexane was more active than dichlorodiphenyltrichlorethane.

The mites belong to those insects which are immune to various poisons. Their eggs do not perish even by fumigation with hydrogen cyanide acid and with chloropicrin. The absence of mites in dusted grain indicates that, if their eggs were not even killed by the compounds, the larvae perished anyhow.

The dusts did not affect the grain sprouts.

A five percent dust of hexachlorocyclohexane was tested upon caterpillars as a contact and intestine insecticide.

As a poison of contact effect, the compound was tested by spraying it in Stepanov's equipment, with the consumption of 10, 20, 40 kg/ha (the batch of the instrument is of 40, 80, 160 mg) in controlling caterpillars of gypsy moth [Porthetria dispar] and of apple moth.

Five percent hexachlorocyclohexane dust caused almost the complete destruction of gypsy moth with the consumption of 40 kg/ha; dichlorodiphenyltrichloroethane caused the same effect with the consumption of 10 kg/ha.

Table 2

Compound	Correlation between the compound and the grain	Results of the effect of the compound upon the mite
Hexachlorocyclohexane.....	1:500	After 25 days there was no mite
"	1:3500	" 20 " " " "
Dichlorodiphenyltrichlorethane	1:3500	After 30 days individual mites
The same.....	1:500	After 30 days no mites
Gezarol.....	1:500	After 30 days individual mites
"	1:350	After 30 days no mites
Talcum.....	--	{ During the entire experiment there was a great amount of mites.
Control.....	--	

Table 3

Compound	Mortality in percentage during consumption	
	36 kg/ha	12 kg/ha
Hexachlorocyclohexane 5 percent dust.....	96	78
Dichlorodiphenyltrichlorethane... 5 percent dust.....	99	89
Gezarol.....	100	96
Calcium arsenate 36 percent.....	94	80

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The effect of hexachlorocyclohexane and of dichlorodiphenyltrichlorethane upon the caterpillars, i.e. upon gnawing insects is most important. Poisons of intestine effect are applied in controlling them: usually they are compounds of arsenic which are poisonous for warm blooded animals. The possibility of replacing such insecticides is of great importance. Besides, the possibility of applying the same insecticide in controlling both insects, suctorial and gnawing, makes this insecticide universal.

The dusts containing 7 percent of hexachlorocyclohexane and "gezarol" containing 5 percent of dichlorodiphenyltrichlorethane were sprayed upon nests with caterpillars of the second generation of apple moth. After twenty-four hours the destruction of caterpillars from hexachlorocyclohexane reached in one experiment 83 o/o, and in another 97 percent. After forty-eight hours the caterpillars perished completely. Gezarol caused the destruction of 57 percent of caterpillars after twenty-four hours in one case, and in the other case-83 percent. After forty-eight hours their complete destruction followed.

A five percent dust of hexachlorocyclohexane was tested by sulfur method, as a poison of intestine effect, in controlling the caterpillars of cabbage owlet moth [Barathra brassicae] with the consumption of 20 kg of the compound for one hectar of the surface. The results were negative, while "gezarol" caused complete mortality of the caterpillars. Hexachlorocyclohexane had a repulsive effect upon the caterpillars: they did not touch the attractants.

Similar results were obtained at the laboratory of the Main Botanical Garden of the Academy of Science of USSR by the coworker Ferdennikova S. P. With the consumption of 25 kg of the compound for 1 ha of the

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surface, 23 percent of the caterpillars died on the third day. "Gesarol" under the same conditions caused the death of 93 percent of caterpillars, and 5 percent dust of dichlorodiphenyltrichlorethane caused 69 percent, and calcium arsenite-43 percent.

Five percent dust of hexachlorocyclohexane proved to be highly effective already on the third day upon caterpillars of the third generation, as an intestine poison. But still this compound was inferior in its effect to dichlorodiphenylchloroethane. This is well proved when applying a smaller norm (12 kg/ha) of the compound. (Table 3, page 8.)

During the experiments at the Voronezh Oblast' Agricultural Experimental Station, two hours after spraying millet lots (size 10 m²) infested by millet mosquito [Mayetiola destructor], a great amount of dead mosquitoes were discovered upon the ground and upon registration sheets. Flying mosquitoes were observed in individual specimens. Upon control lots there was an intensive flight of mosquitoes. Dichlorodiphenyltrichlorethane were active more slowly, but they yielded the same results.

During the spraying of raspberry and of apple trees with 5 and 7 percent dust of hexachlorocyclohexane there was no burning of the leaves.

The laboratory of the Botanical Garden made experiments with 5- and 10 percent dust of hexachlorocyclohexane upon cherry, lilac, raspberry and apricot trees, whereby for two weeks there was no burning of the leaves. But, on the leaves of cucumbers in conservatories burns were noticed.

The literature on applying hexachlorocyclohexane as an insecticide is insignificant. The compounds of hexachlorocyclohexane have several names: 666, three six, "Gammeksan". The latter name pertains to the

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compounds of gamma isomer hexachlorocyclohexane. In USSR this compound is called Hexachloran.

"Gammeksan" proved to be highly toxic for insects and for some other jointed animals.

According to Dr. Slade, a poisoned attractant of 0.02 percent mixture of the isomers of hexachlorocyclohexane caused the destruction of 62 percent of flying locust during two days, while dichlorodiphenylchloroethane at the concentration of 0.2 percent caused 57 percent of its destruction, and sodium arsenite caused 57 percent of locust destruction at the concentration of 0.4 percent.

The larvae of the 4th and 5th stage of the flying locust sprayed with the hexachlorocyclohexane dust perished within twenty-four hours, those sprayed with "gezarol" did not perish.

The first experiments indicated that:

1. Hexachlorocyclohexane in the form of 5- and 7 percent dust mixed with talcum proved to be a highly effective insecticide of contact effect upon aphids, flea bugs, thrips, caterpillars of younger generation, locust, upon rice weevil and cereal mites during the spraying of grains.
2. According to its effect upon aphids, the dust of hexachlorocyclohexane is much superior to the dichlorodiphenylchloroethane which, in a series of experiments was little effective in controlling aphids, and according to literature data, is entirely ineffective in controlling aphids.
3. As an insecticide of intestine effect, hexachlorocyclohexane requires further study upon various gnawing insect species.
4. Hexachlorocyclohexane and dichlorodiphenyltrichloroethane are not ovicides.

During the experiments with hexachlorocyclohexane dust neither burning effect upon the plant nor upon the sprouting of wheat seeds could be observed.

5. Hexachlorocyclohexane is a universal insecticide which preserves its effect for a long time and is effective in controlling suitorial and gnawing insects.

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It could be recommended for wide experiments as a 5-7 percent dust in controlling suctorial and gnawing insects and also for spraying grains, if it will not contradict the sanitary requirements.

ADV-10-1-51

Ways of investigating new herbicides.
Leningrad. Inst. Zash. Rast. Sbornik
5:61-67. 1933. 464.9 L542

Translated from the Russian by S. N. Monson

(From publications of Sector of Weed Control of VIZRa)

One of the major factors in the control of weed vegetation by chemical method is the selection of the most active herbicide.

In selecting a herbicide one is not guided by activity alone. The substance must also be inexpensive, obtainable, represent a product of domestic production, manufactured from ordinary available raw material, i.e. must be chosen after all technological economic reasons have been considered.

Table 1 presents major basic substances used in weed control abroad and in our own practice. This table does not exhaust the list of herbicides. Several substances found in literature, such as boron fluoride, mercuric chloride, etc. have been deliberately omitted from the table since they cannot be used extensively in our country as herbicides or because of their high cost (boron is available in the Soviet Union only in very limited quantities), or yet because of other negative properties. In addition, substances have been omitted from the table which representing by-products of principal industries, such as sodium bisulfate, residue from the production of chloride, obtained according to the old method through the action of sulfuric acid upon common sodium chloride.

The active element in acid sulfate is sulfuric acid, the content of which determines the degree of activity of this herbicide. In studying the substances we consider only pure concentrated herbicides which produce maximal active effects.

The use of by-products containing active substances may in many instances compensate for the lack of full-bodied herbicides, but in the

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majority of cases wastes possess only local limited significance in view of their low concentration (from much dilution with water) and large volumes and weight (50/o of alkali, for instance) which require unwieldy containers unsuitable for transport. Occasionally wastes containing large amounts of active substances do not provide opportunities for their application in weed control because of limited quantities or high degree of contamination with injurious substances harmful to the soil.

TABLE I

PRINCIPAL SUBSTANCES APPLIED IN WEED CONTROL (HERBICIDES)

ACIDS:

1. H_2SO_4
2. HNO_3
3. HCl
4. H_3PO_4
5. $SO_2 + H_2O$

ALKALI:

6. $NaOH$
7. KOH
8. NH_4OH
 NH_3
9. As_2O_3

SALTS:

10. $[FeSO_4 \cdot 7H_2O]$
11. $[CuSO_4 \cdot 5H_2O]$
12. Na_2HAsO_3
13. Na_2HAsO_4
14. $CaO \cdot As_2O_3$
15. $CaHAsO_4$
16. $CaCN_2$
17. $MgCl_2$
 $KCl \cdot MgCl_2 \cdot 6H_2O$
 $KCl \cdot MgSO_4 \cdot 3H_2O$
 $KCl + MgSO_4 \cdot H_2O$
18. $NaClO_3$
19. $Ca(ClO_3)_2$
20. $Mg(ClO_3)_2$
21. $KClO_3$
22. $NaClO_4$, $KClO_4$
23. $K_2Cr_2O_7$
24. $Na_2Cr_2O_7$
25. NaF

Organic Substances:

26. $HCOH$, CH_3COH
27. C_6H_5OH , $CH_3C_6H_4OH$
28. $NH_2C_6H_5$
29. $(C_6H_4Cl_2)$

As seen from table 1, herbicides may be divided into the following groups: 1. acids; 2. alkali; 3. salts; 4. organic substances. All acids are herbicides because of the presence of "active hydrogen ion" in these compounds which act toxically upon plants (living protein substance of the cell.) However, the problem remains, --which of the acids should be applied as a herbicide for volume work?

Parallel tests upon the activity of various acids (sulfuric, hydrochloric, nitric, phosphoric, sulfurous) performed on a mass scale on large areas under uniform conditions, which take into consideration economic effects, were unfortunately not conducted by us; they will be dealt with in subsequent experiments; if the reaction is the same from identical dosages in weight (which is doubtful), preference should be given to acid which is less expensive and available, not only at present but with an eye to future chemical industrial outputs in the second five-year plan.

Sulfuric acid, most popular with us and abroad, is currently the least expensive substance. Its cost is \$15.00 a ton (29 gold rubles) in the New York market. If obtainable in the domestic market at 85 to 100 rubles per ton now, its price will drop to 35 rubles by the next plan. The chemical is nevertheless not plentiful and may be used for weed control at the expense of the amount allocated for the preparation of superphosphate fertilizers.

If at present our cost of hydrochloric acid is equal to that of sulfuric acid (costing also 85 to 100 rubles), it may be obtained in the future in larger quantities from an expanding industry of organic chlorine compounds when its price will undoubtedly drop to 15-20 rubles per ton. It should be borne in mind, however, that hydrochloric acid represents approximately 40 o/o of solution of hydrogen chloride in water at a

specific gravity of 1.19. In America the practice is to transport pure 1000/c gas in cisterns, i.e. hydrogen chloride transformed through pressure into liquid state. In such case hydrochloric acid will evidently prove more profitable than sulfuric acid. Nitric acid developed synthetically from nitrogen and hydrogen is of especially great significance for controlling weeds. Here we come across an interesting case of the mixed action of this substance. At first nitrous acid acts upon weeds as an acid and herbicide, later as nitrogen fertilizer for the soil (table 2). An analogous picture is obtained in the case of phosphoric acid. First it acts as a herbicide, then as a fertilizer. In view of its considerable output based on Khibin apatites, its cost will tentatively be about 155 rubles per ton. All soluble alkalis possess, as do acids, high herbicidal characteristics because of the presence of hydroxyl group OH.

Table 2

HERBICIDES-FERTILIZERS

1. Nitrogen fertilizers:

1. $\text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2$
2. $\text{NH}_3 \rightarrow \text{HNO}_2 \rightarrow \text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2$

2. Potassium fertilizers:

3. $\text{KOH} \rightarrow \text{K}_2\text{CO}_3$
4. $\rightarrow \text{KCl}$

3. Phosphoric fertilizers:

5. $\text{H}_3\text{PO}_4 \rightarrow \text{CaHPO}_4$
6. $\text{POCl}_3 \rightarrow \text{CaHPO}_4 + \text{CaCl}_2$
($2\text{POCl}_3 + 6\text{H}_2\text{O} = 6\text{HCl} + 2\text{H}_3\text{PO}_4$)
7. $\text{PCl}_5 \rightarrow \text{CaHPO}_4 + \text{CaCl}_2$ ($2\text{PCl}_5 + 6\text{H}_2\text{O} = 10\text{HCl} + 2\text{H}_3\text{PO}_4$)
8. $\text{P}_2\text{O}_5 \rightarrow \text{H}_3\text{PO}_4 \rightarrow \text{CaHPO}_4$

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Caustic soda represents a very valuable economic product in view of its vast application. It will hardly be possible to apply it for weed control in large quantities, particularly since its price abroad (about \$50.00 per ton) and at home will not be greatly reduced, and may not be any less than 130 rubles per ton.

Caustic potassium is a more valuable product in view of the greater value of the raw material used in its production; it will equally be of dual action, first herbicide, and later potassium fertilizer. This dual action of the substance requires very thorough processing in mass experiments on ^{large size} considerable plots, a circumstance which should be included into the plan of research work in the following year.

The group of salts produces a large amount of herbicides. In the USA copper salts, compounds of arsenic, lead, i.e. salts of heavy metals are extensively used. This group of salts, lacking in our newly developing industry, particularly compounds of copper, essential for the electrification of the country, is altogether unsuitable for introduction on a large scale in the capacity of herbicides and cannot be depended upon in the near future. Considering that abroad the appearance of herbicides from the group of salts takes place upon the initiative of private individuals and firms, an enormous amount of these appears on the market, representing mixtures of the principal active substances in different variations with admixtures of different fillers.

Among the principal herbicides contained in patented mixtures are chlorates. In 1922 in France there appeared a patent of the Loyer plant and the chemical society de Massy Pubaiseau Reunis (F.P. 566459, of August 24, 1922, published February 15, 1924), which was offering chlorates and perchlorates as a means for weed control; it was recommended to mix the substance in dusting with sand, talcum and other substances. In the

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same year, E. Teppet (F. P. 547599 of January 31, 1922, publ. Dec. 19, 1922) recommended the use of sodium chlorate and potassium chlorate as herbicides, indicating that both were supposedly to be applied as such or with the addition of sodium or potash, especially sodium or potassium dichromate. Ralph Nelson Cipman (F. P. 660,265, Sept. 19, 1928, publ. July 9, 1929) suggested the use of a mixture of 3 parts of sodium chlorate and 2 parts of potassium chlorate and recommended its use in powder form. E. Teppet (F. P. 644,166, Feb. 21, 1927, publ. Oct. 8, 1928) proposed chlorates of all kinds for weed destruction. According to the patent, the principal composite part is sodium chlorate or potassium chlorate, as such or mixed with other substances, particularly sodium or potash. Jean Schneebeli (Swiss patent 129,209 of May 1, 1928, publ. Dec. 1, 1928) proposed a solution of sodium chlorate subjected to electrolysis, i.e. sodium perchlorate.

It follows that in all this group of listed patents the principal active substances were chlorates (potassium, sodium and calcium), the remaining mixtures were of no particular significance in action and served only to warrant the patent. The preparation "Unkraut-ex", issued by the firm Scholte and Charlier and patented in Germany, differs from pure sodium chlorate only by its attractive label and the addition of 10-15% of soda, an almost inactive substance.

The application of sodium chlorate in USA increases steadily from year to year; thus in 1919 it amounted to 17.7 m.; in 1927-693.9 m.; in 1929-3513.4 m. (at a cost of 154 dollars per ton). Let us note that the manufacture of sodium chlorate in the USA is not established and that this product under the designation sodium chlorate is imported from

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Germany. Potassium chlorate is as effective as sodium chlorate. Its application is particularly recommended on acid soils. It is easily obtained by chlorinating milk of lime at a temperature of 40-60° and represents an intermediate product for obtaining potassium chlorate chemically; to separate it in pure form, however, is difficult in view of its hygroscopic nature. In the USA potassium chlorate, under the designation "Atlasite" with the addition of substances stabilizing this salt is produced in solid form and is a solid product. Its cost is naturally lower than that of sodium chlorate. An analogous preparation, magnesium chlorate, is altogether unknown in a dry state; it could also serve as a herbicide.

In our search for new herbicides attention was drawn to chlorine preparations. (table 3).

TABLE 3

New Herbicides--strongly active (chlorine group) and chemism of their action.

1. $(Cl_2 + H_2O = 2HCl + O)$
2. $(2S_2Cl_2 + 2H_2O = 4HCl + SO_2 + 3S)$
3. $(2S_2Cl_4 + 4H_2O = 4HCl + 2SO_2 + 2S)$
4. $(SO_2Cl_2 + 2H_2O = 2HCl + H_2SO_4)$
5. $(SiCl_4 + 2H_2O = 2HCl + SiO_2)$

The results are most favorable; they established the particular activity as herbicides (see table 4). The action of indicated chlorine preparations is based on the fact that they decompose rapidly into hydrochloric acid and molecular sulfur (in applications of chlorine and bichlorine sulfur) from moisture in the air and plants. The second group of experiments searching for new herbicides uses liquid chlorine for this purpose.

It is known that chlorine exercises a strong burning action upon vegetation, but it is unsuited for use as it disperses in the air and the percentage of application is negligible. In addition, it is dangerous to conduct work with a gaslike and poisonous substance that may be directed by wind anywhere. I therefore suggested to test the action of chlorine dissolved in chloride-organic solubles, such as 4-chloride hydrogen, dichlorethane, tetrachlorethane, etc. The application of a liquid for the above purposes in place of gas makes the work easier. (See Table IV, p. 11.)

A mixture prepared of carbonyl 4-chloride and liquid chlorite in the proportion of 1:1, had in iron cylinders a pressure of about 3 atmospheres, this offering a significant advantage since the mixture was easily thrown ~~out~~^{from} the cylinder under pressure without additional forcing. The exuding liquid has low temperature (to 10° C) and aside ~~of~~^{from} its burning action may freeze vegetation. The inadequacy of these mixtures lies in their severe poisonous action to the environment which calls for particular care.

In comparing the above herbicides with chlorates, we have to stress that they may easily replace chlorates, since a large amount of chlorite is used for the production of the latter by chemical means, i.e. to one part of chlorite 5 parts⁸⁰ for the formation of potassium chloride which represents waste.

In dosages which do not exceed dosages of chlorates, chlor-products have possibilities for partially replacing chlorates; the work should therefore be conducted on extensive fields to judge the technique of application and economic profitableness of these substances, compared to other herbicides (chlorites).

With regard to spraying methods, they have been well-studied and only

TABLE IV
RESULTS OF EXPERIMENTS IN CONNECTION WITH SEARCH FOR NEW HERBICIDES

Name of Herbicide	Dosage for 1m ² in gr.	Concentration of applied so- lution in o/o	Effect of action according to established scale	Remarks	
I-In Nurseries					
4-Carbonyl.....	25	100	1	} Plant death-100 o/o	
" "	50	100	2		
" "	60	100	2		
" "	80	100	2		
Sulfur dichloride.....	25	100	3		
" "	50	100	3		
2-Sulfur dichloride.....	25	100	3		
" " "	50	100	3		
II-On Field plots of 1 sq. m.					
4-Carbonyl chloride.....	80	100	2		
" " "	100	100	2		
Sulfur dichloride.....	30	100	3		
" " "	50	100	3		
III-On Field plots of 5 sq. m.					
4-Carbonyl chloride.....	50	100	1		
" " "	100	100	1		
" " "	130	100	2		
" " "	160	100	2		
Chloride in 4-carbonyl chloride.....	25	10+90	2	} Plant death-90 o/o	
" " " "	50	10+90	2		
" " " "	80	10+90	2		
" " " "	100	10+90	3		
Sulfur dichloride.....	10	100	1		
" " "	20	100	2	} Plant death-60 o/o	
" " "	30	100	2		
" " "	40	100	2	" " 70 o/o	
" " "	50	100	3	" " 90 o/o	
" " "	60	100	3	" " 90 o/o	
2-Sulfur bi-chlorite....	20	100	1	}	
" " "	30	100	2		" " 90 o/o
" " "	40	100	2		
" " "	50	100	3		" " 100 o/o
" " "	60	100	3		" " 100 o/o
Under other tested substances we shall refer to:					
I-Under Nursery conditions:					
Xantogenat of potassium..	25	10	3	} " " 100 o/o	
" " " ..	50	10	3		
II-On Field plots of 1 sq. m.					
Xantogenat of potassium	25	10	1	} Contains aldehyde of superior grade-100-155° Plant death-100 o/o	
" " " "	50	10	2		
Waxes-S.K. yellow oils	50	100	2		
" " " "	100	100	3		
" " " "	150	100	3		
Key designations: 1. plant death to 20 o/o 2. plant death to 50 o/o 3. plant death above 90 o/o					

points connected with the selection of material for specific apparatus have to be learned.

In view of the severe burning action of these substances upon plants, control should be directed to destroy weeds in the fall and spring up to the time of planting of cultivated crops, destruction of vegetation on arable ("pary") fields and sections of particular contamination for burning.

Such is the field for the application and potentialities ^{for} ~~ix~~ using chlorine and chlorine products in agricultural practice for weed control. In considering the importance of the chemical method for the control of weeds on fields, vegetable and flower gardens, forests, etc., it is essential to recognize that its development may be based on:

1. sufficient supplies of substances-herbicides;

Among these substances major attention should be directed to the production of concentrated active herbicides of which the manufacture should be steady to correspond with the needs of ^{expanding} ~~growing~~ weed control;

2. Use of wastes from industrial production which in some cases replace valuable substances, though they are of local and limited significance in view of low concentration, large addition of water, volumes and weight, which makes them inadmissible for transport where appropriate containers are lacking.

3. It is necessary to reduce constantly the assortment of active substances while searching for new more effective herbicides and ^{to} ~~consider~~ such factors as economical value, simplicity in manufacture from available raw material, and the possibility of mass output.

4. In view of the special active characteristics of chlorates as herbicides, particular attention should be devoted to the manufacture of sodium chloride of standard quality; simultaneously, search for methods of producing other,

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less expensive solid chlorites (potassium-and magnesium chlorides) should be speeded, since the latter may along with chlorites of alkaline metals exhibit the same action at lower cost.

5. In conducting mass experiments on fields in connection with weed control, special attention should be devoted to the choice of substances which exhibit dual action: first herbicidal, then serving as fertilizers for cultivated plants (potassium chlorate, potassium cyanimide, nitric acid, ammonia, phosphoric acid, and phosphorous anhydride, chlor-phosphoric compounds, etc.)

6. To direct attention at mass experiments on fields to the particular action produced by chlorite and chlorite products.

End of article

ADV-10-2-51

Vsesoiuznoe Gosudarstvennoe Ob'edinenie Transl.225:Plant Protection
po Bor'be s Vrediteliami i Bolezniami v
Sel'skom i Lesnom Khoziaistve.
Postanovleniia, pravila i instruktsii po karantinu
protiv vreditel'ei i boleznei sel'skokhoziaistvennykh
kul'tur (Resolutions, rules and regulations on
quarantine in controlling agricultural pests and
diseases), 3, 40 p. 1933. 464.9 V962

Translated in part by
S. N. Monson

Excerpt from the Introduction: (p. 3)

The material published in this collection of directions reflects the qualitative changes made towards intensifying the development of the present stage in plant quarantine in the USSR. It should, as did the two preceding issues, serve as a practical guide for fulfilling quarantine regulations in the interests of further development of socialist agriculture.

(Signed) Quarantine Sector OBV

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End of Pamphlet

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